The Chips Fly! Speed-Testing the NeXT, SPARCstation 2, and Mac IIfx

# NeXTWORLD

APRIL 1991

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## Heidi and Alvin Toffler

**Powershift in the Information Age**

## Showdown

**NeXT, SPARCstation 2, Mac IIfx**

**Price, Power, Performance**

## It's Hollywood NeXT!

**Tracking the Stars**

**With William Morris**

**Product Reviews**

Digital Microphone

NeXTmail

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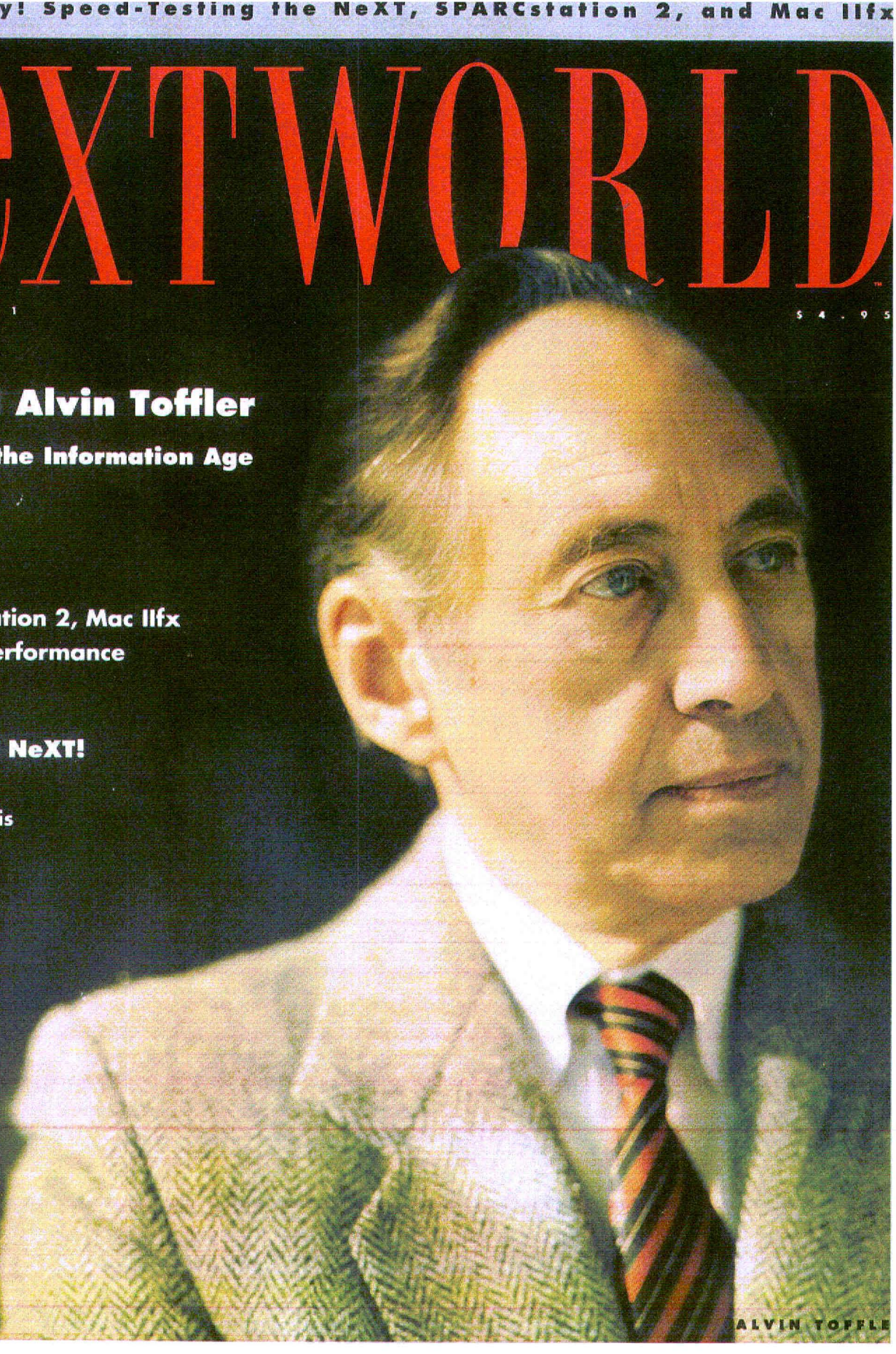

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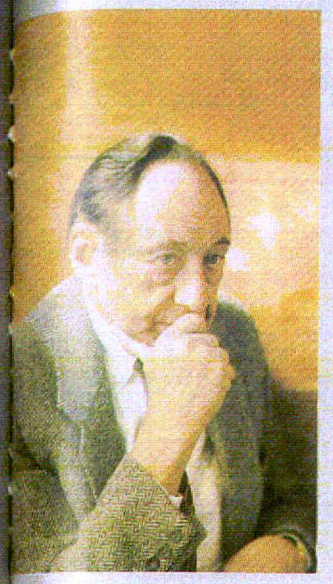

NeXTWORLD™

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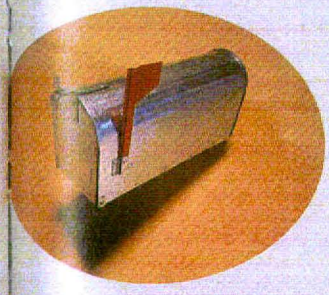


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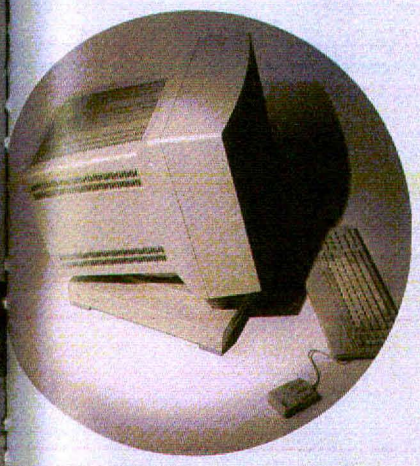

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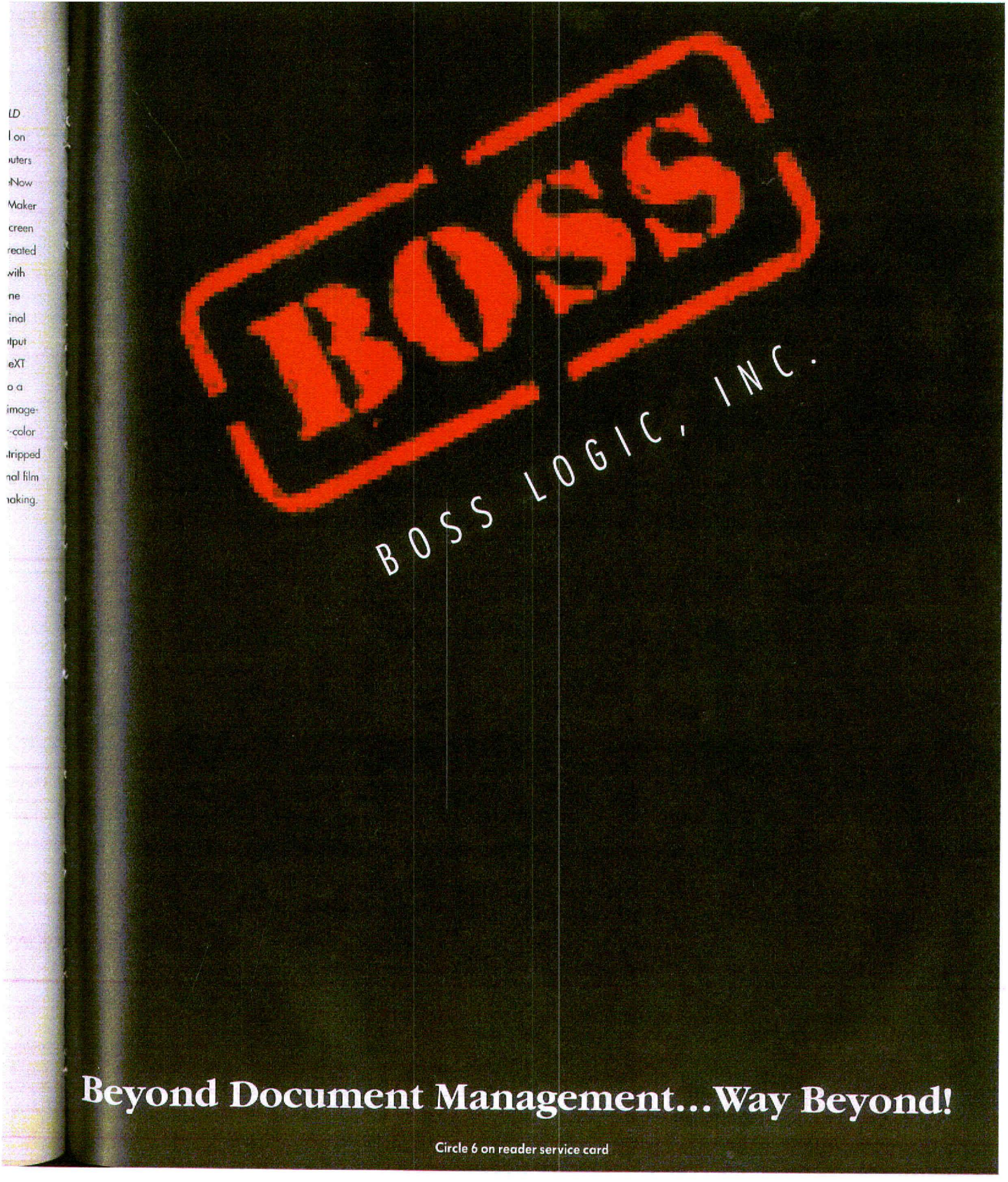


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# Letters

### The Other Worlds

Now I want a Cube, and it's all the fault of your first issue!

Until reading your articles on music and real-time video, I did not really comprehend what the NeXT was all about. It was not clear to me why this was a real step forward in the PC revolution.

Instead of going for a '486 motherboard, I'm now considering a Cube. People buy computers to run the particular programs they use and view as essential. In my case, it's Ventura. What really turned me around was finding out about SoftPC for the NeXT. If I can run DOS/GEM Ventura, or even Windows, then the NeXT *really* makes sense.

I urge you to provide continuous coverage of other-world applications running on NeXT under an emulator. If NeXT had both a good SoftPC and a great SoftMac, NeXT owners would have all three worlds in one!

Yo! Steve! Listen up!

**Malcolm Dean,** *Senior Editor*
*Office of Academic Computing*
*University of California, Los Angeles*
*Los Angeles, California*

### Double-Sided Policy

NeXT should take cues from Dan Lavin's column about beefing up sales channels (NeXT Ink, January/February 1991), because they need better distribution.

Few people know this better than I. I have been trying hard to buy a NeXTcube since late October but haven't been able to find one. According to a person I talked to at NeXT, deals with several retail chains are in the works. No deal would come too soon for them, since BusinessLand is a complete washout.

I've also been thinking about the sore point of removable media. If you asked NeXT about floppies a year ago, the response was, "Why do you need floppies when you have optical?" Ask the same question today and the response is, "Why do you need optical when you have floppies?"

I speculate that both NeXT and Canon had planned to have a double-sided, high-speed optical drive ready by the end of 1990. But when they apparently weren't ready to ship, NeXT was left with the marketing problem of what to endorse. Obviously, they had to endorse floppies, since floppies were badly needed in the first place. But with the optical, they had to either discourage users from buying it until the new double-sided drive was ready or continue selling the slow, single-sided disks and drives and then face the music from users when the new technology arrived.

It seems that NeXT and Canon took the safe road. That would explain the sudden about-face of NeXT's opinion on optical drives. It would also explain Canon's current "shortage" of single-sided optical disks.

**John Coppinger**
*Lexington, Kentucky*

### Exchanging Ideas

It's about time the NeXT community had its own periodical. Thanks for the superb premiere issue of *NeXTWORLD*.

It seems that I live to exchange hordes of data between a PC and a Mac. Although not a particularly pleasant task, I have learned, as a management consultant, to live with this necessary evil. The NeXT was to be my savior from this drudgery.

I had hoped (and still do) that interactive links could be established between a fast, functional relational database—like Paradox—for the NeXT to feed data to a spreadsheet—like Improv—that could make function calls to Mathematica and then send output to a custom-programmed front end using Interface Builder, et al.

I am excited about the platform, but I hope the software vendors are listening. A powerful machine like the NeXT deserves *better* than what is available on PCs and Macs.

**Michael A. Duke**
*Logan, Utah*

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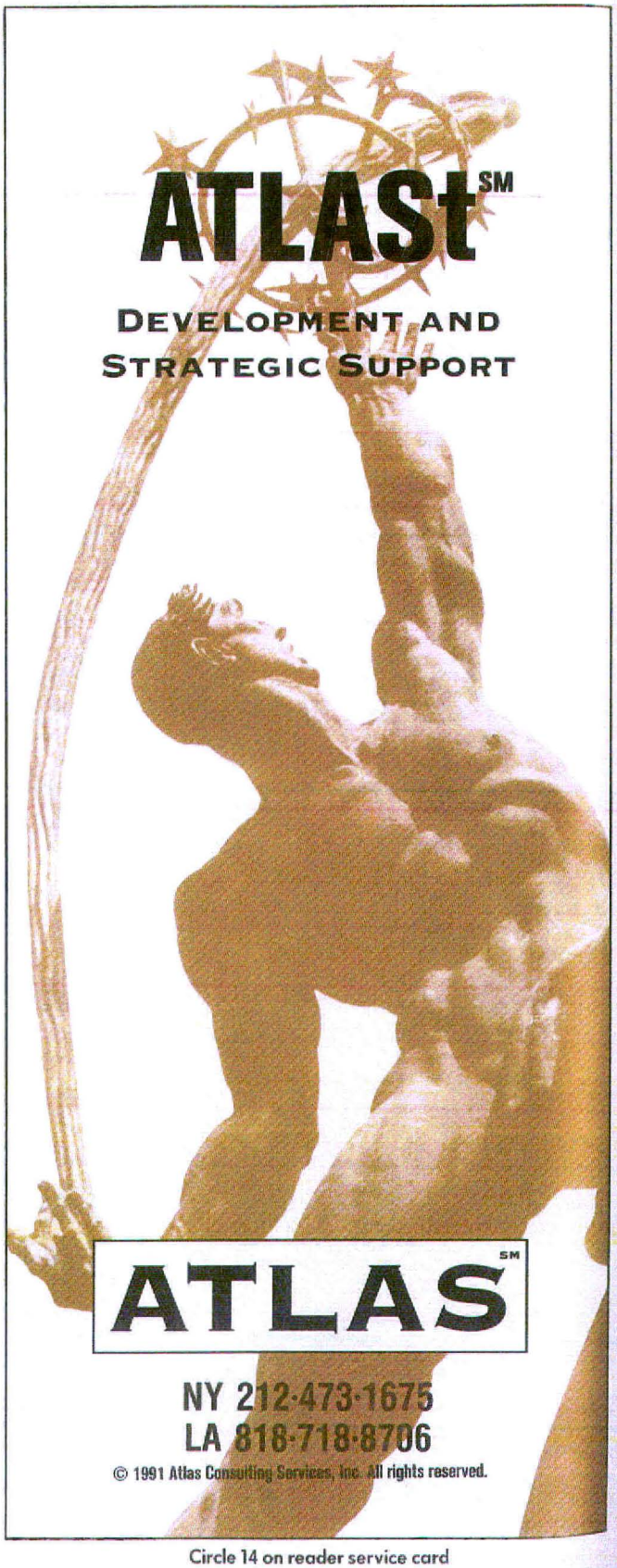

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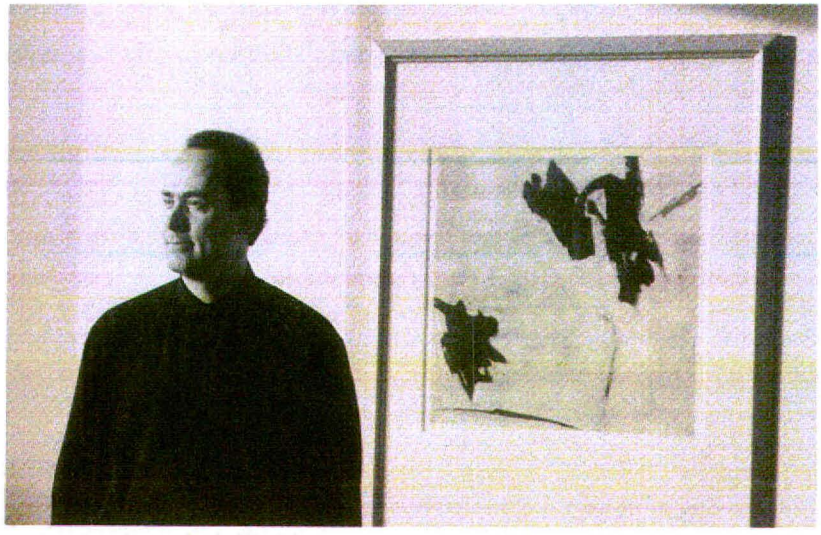

# Black Box/Michael Miley

**Once in a while, an event in the computer industry wakens dead hackers from their slumbers. One such event was the unveiling of NeXT's new professional workstations on September 18, 1990. In Davies Symphony Hall in San Francisco, Steve Jobs stood on the stage, outlined the history of microcomputers, and wowed the audience with the three revolutionary new machines that now set the pace for the future.**

Here's another event in the same spirit. On January 23, at the Meridien Hotel in San Francisco, Go Corporation of Foster City, California, showed a prototype of its long-awaited operating system for pen-based notebook computers. Though the prototype notebooks used for the announcement were big and a bit heavy, you could still hold them in one hand and write with the other. Which is the point. A very big point.

Others thought so, too. Everyone was there: Jean-Louis Gassée, former senior VP of research and development of Apple; Stewart Alsop, trenchant industry analyst; IBM types; Apple and NeXT VPs; and the press, en masse. Pretty impressive. The software is a real innovation and should sell big. NCR Corporation of Dayton, Ohio, which will license Go's PenPoint software in a notebook computer that it plans to release this year, estimates that 1 million pen-based computers, worth about $2.3 billion, will be shipped in 1991 alone. Prediction, or self-fulfilling prophesy?

I'd say the prophets are lining up with the profits. Go has already won the backing of IBM, which has licensed PenPoint for a line of notebook computers it has under development. Some 40 companies are working on PenPoint projects. Bill Campbell, former CEO of Claris Corporation, the software arm of Apple, has jumped to Go to join founders Jerry Kaplan (originally from Lotus) and Robert Carr (originally from Ashton-Tate). And Bill Gates, head of the giant Microsoft Corporation, is scrambling to push his own system. Is this a new wave in computing? You bet. If you put your ear to the ground, you can hear the phones in Foster City ringing off their hooks.

But the question is, what does all this have to do with NeXT? Plenty. Think of it as a missing link for the moment.

**Go directly to NeXT.** When I travel down Highway 101 on my way to NeXT, I often glance at the giant 21-story Metro Center tower that looms over the highway in Foster City. Home to Go Corporation, *MacUser* magazine, and a number of other high-tech firms, it stands imperturbably above the landfill, a sturdy survivor of the 1989 earthquake that shook the valley to its foundations.

When you travel down Highway 101, go directly to NeXT, but do not pass up Go. While Bill Gates readies Pen Windows, a system tacked onto Windows 3.0, Go has built its pen-based system from the ground up, a step that shows a kindred spirit with the bold folks at NeXT who've often defied conventional wisdom for the sake of innovation. Instead of using a windowing strategy based on an interface of keyboards, mice, and disks, Go has developed its own object-oriented operating system and a Notebook User Interface for recognizing that revolutionary object called the pen.

With PenPoint, a notebook computer, and an electronic pen, you manipulate the computer with pen gestures such as circles, arrows, and taps. To delete something, you draw an X over it. To insert text, you draw a caret (^) where you want it to go. When you write, handwriting-recognition software transforms your hand-printed characters into computer-readable text. And you can draw, right on the electronic page.

The building engineer for Metro Tower could



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have used such a notebook after the quake. The first thing he had to do was inspect the building. That meant walking around every room, down every corridor, taking notes as he went, making quick, cursory sketches of cracks he'd noticed in the building or in the parking lots on either side, noting where pipes had broken and water had flooded low spots in the concrete. No laptop would have helped him here (he didn't have a lap). But when he was done, he still would have gone back to his office, plugged the thing into his workstation, and uploaded the data he'd tweak before e-mailing it to his boss.

Bingo. A missing link between the individual and the group. Which brings us back to NeXT.

**Groups on the go.** The scene that follows is a futuristic one that could have come straight out of Alvin Toffler's new book, *Powershift*. (See our interview with Alvin and Heidi Toffler in this issue.)

The year is 1996 and you're one of 15 sales reps in the boardroom at NeXT's Redwood City headquarters. It's the national sales meeting and the meeting has gone well. The NeXT has sold like hotcakes in the university, financial, medical, legal, and DTP markets. The message of a professional workstation for group computing has gotten through, loud and clear.

Your electronic notebook is plugged into a network socket under the boardroom table, just like those of the other 14 reps. Some of them have Grid logos on them, others have that familiar multicolored cube. After you give your spiel, you upload your figures to the wall-board computer for everyone to see (though you don't upload the notes you've taken on the spot). When you are done, Steve Jobs, president of the company, downloads them to the NeXTstation humming in the corner, so he can review them more carefully in his office. No doubt, you'll get his response later via e-mail. You, in turn, download the other reps' figures to your notebook to compare them with your own.

Point #1: A notebook computer, using forms that can be filled out simply with a pen, is an important way for a business professional to plug into his or her workgroup, solving different problems from those of a keyboard computer, though the Go system also allows it to be used with a keyboard. In short, a notebook computer can complement a full-powered stationary workstation. One is not a substitute for the other.

Any other advantages? Well, back in January, as *NeXTWORLD*'s technology editor, Dan Lavin, and I milled around in the hallway at the Meridien, we ran into Stewart Alsop and stopped to chat. Alsop talked about Go's risky decision to build a new pen-based operating system from the ground up, contrasting it to Microsoft's safer strategy of building one within Windows 3.0. I thought: From Microsoft's standpoint, it doesn't matter if it's jerry-rigged under Windows; pen-based computers need to be compatible with the installed base of DOS machines. From Go's standpoint, however, the world needs to move forward, so Go stuck its neck out and did something risky. When Alsop talked about object orientation and the embedded document architecture of PenPoint, he didn't mention Go's multitasking, but the issue fits into their strategy. It fits NeXT's strategy, too.

When you use the Go system, you plug your applications into the background, at a layer close to the operating system itself. You don't "launch" programs to do your work. You assemble complex documents that draw on the application resources you've loaded into your notebook. If you have to edit a drawing, you do it right there in the text document, calling up the drawing functionality you've bought to do just that. That's what an embedded architecture is all about. Go's multitasking helps you do this. Let's see Microsoft pull this one off in a Windows environment.

But I'd gotten this message before. The NeXT is just such a multitasking system and understands embedded architectures. It always has. When *NeXTWORLD*'s managing editor first sent me a NeXTmail message with an enclosed WriteNow document for my inspection, I just double-clicked on the document icon in the message window. The NeXT launched WriteNow in the background so I could read the document, an article from an author who uses a Mac. (We translated the document over our GatorBox via RTF format.) The operation can also be used for spreadsheets, graphics, and sound documents, while enclosed TIFF documents don't even require a click: they're already displayed. (For more about the GatorBox and NeXTmail, see our review in this issue.)

Point #2: Full-powered, embedded architectures can only work well in a multitasking environment.

I'd gotten the message, too, when I saw how the Services menu works for interapplication communication. (The Services menu is a NeXTstep "speaker/listener object," in which one program speaks and another listens without having to know who's speaking or listening.) Let's say you receive a fax over the system, which you'd like to pull into your work stream of editable text. All you have to do is pull up OCR Servant from the Services menu and scan the bitmap of the fax. Voilà. Editable text. Or, let's say you want to turn your text into a fax. You can. With the current Mac system, you need to build links into your program. With NeXT's Services menu, programs don't have to know what other programs are doing to establish links between them. All this is possible because of NeXT's Mach kernel, which supports a mechanism for interprocess communication, and its object-oriented environment. You can expect other "objects" to be plugged into the NeXTstep environment in the future.

Point #3: Seamless groupware can only be developed effectively in an object-oriented environment. And NeXTstep is the best object-oriented environment in the world.

And so why am I making all this fuss about a notebook computer in a magazine devoted to the NeXT workstation? Because together they represent a total solution for the same professional markets. People are free agents who also work in groups. The point here is that Go and NeXT don't have *competing* operating systems, but *complementary* ones. Together, they represent innovative solutions for the future, not hacks to the past.

Which brings me to my final point. NeXT needs to leverage its alliance with IBM and its kinship with Go to keep Microsoft from monopolizing these markets. Go should build links to the NeXT environment for seamless interpretation cooperation. Or maybe the next step for NeXT is to develop their own pen-based NeXTstep interface for a notebook computer that can use both a pen and a keyboard, one that they themselves design. A black one, preferably. I'd buy one tomorrow, and when in the office, I'd keep it right next to my Cube.

**Michael Miley** *is editor in chief of* NeXTWORLD.

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# NeXT Ink/Dan Lavin

There is a new and growing market for microcomputers called professional workstations, and NeXT is poised to take advantage of it. A professional workstation (PW) is nothing more than a high-end PC. Its users are people who need a great deal of power—not just MIPS power, but power in multiprocessing, power for group computing, and access to powerful applications. NeXT's software and its mode of distribution give it the potential to be dominant in this market.

The professional workstation is defined by its users. Although there are many types of PC users, a potential PW user is anyone who uses a computer for a critical application that benefits from additional power. This cuts an incredibly wide swath in the PC landscape. Right now, obvious resource-hungry tasks such as publishing, university research, and financial analysis fall into this category. But the PW's destiny is not confined to these specialized vertical markets; early adopters of this advanced technology presage a far wider market.

The key here is to understand that the professional workstation is not a traditional workstation. That beast, powerful though it is, is a specialized machine designed for science and engineering needs. PWs are general-purpose machines. They are and will be used by a wide variety of users. Anywhere an improvement in a person's productivity justifies an increase in computing power, that person is going to want a PW, especially now that NeXT has lowered the ante to $5000 retail.

This general market is both large and important. IDC Research shows that the growth rate of PC sales overall is leveling off. Nevertheless, IDC estimates that rapid growth will occur in limited segments, including workstations and laptops. IDC also predicts rapid growth of UNIX-based machines. A full half of these UNIX installations will be commercial, and not science or engineering, sites.

Translate commercial UNIX into professional workstation. Literally millions of these machines may be sold over the next several years. Remember that people entering the PC market for the first time these days tend to buy systems near the top of the performance curve, not the bottom. In today's world that means a '386SX running Windows 3.0, by and large. Tomorrow that will mean a PW, and that PW might very well be running UNIX.

But a UNIX box, up until now, was a hard sell simply because the machine was tough to use. Though Sun has sold many workstations, it has sold only an estimated 40,000 units in its entire history into commercial (not science or engineering) markets—the PW market. Estimates are that NeXT will ship between 50,000 and 100,000 units this year alone, based simply on the fact that over 25,000 have already been ordered.

The NeXT fits our definition of a PW. It is first and foremost a powerful PC. It was designed to be used by average users. It is a generic base useful for any number of purposes. Furthermore, as a UNIX-based machine it is multitasking—you can run more than one process or application at a time. It's geared for use in workgroups over a network. And finally, the NeXTstep environment breeds better applications. (See the feature "Station to Station" in this issue for a comparison of the NeXT '040's capabilities with those of the Sun SPARCstation 2 and the Mac IIfx.) NeXT's competitive advantages, the most notable of which are software and distribution, stem from these attributes.

**Commercial applications.** NeXT's commitment to interpersonal computing is based on the engineering that went into its machine, which made it particularly well designed to augment the



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power of groups. NeXT is doing this by attracting mainstream software developers to provide off-the-shelf commercial applications for general use. (NeXT has garnered more than 1000 registered NeXT developers to date.) Four of the six largest PC developers—Lotus, Adobe, Word Perfect Corporation, and Ashton Tate—are developing for the platform. Sun, a traditional engineering workstation vendor, has been largely unsuccessful in this mainstream arena because a developer writing a word processor, database, or spreadsheet program wants to aim at a general audience, not the small group of specialists generally associated with the use of of such workstations.

Furthermore, as more general applications are built into the NeXTstep development environment, it will be clear that they're smarter, better, and faster than their DOS or Mac counterparts. Programs like Lotus Improv, written to take advantage of the high-speed processing and superior graphics of the NeXT, will set new standards for professional workstation applications. They'll work well with other applications, taking advantage of NeXT's Services menu to access other applications like Webster's or OCR Servant. They'll exploit multitasking, interpersonal computing, and UNIX.

Apple has been a real champ at attracting mainstream applications, but several problems may hamper it from gathering its share of newer, smarter, more powerful apps. Apple is truly hidebound by the Mac operating system; future operating system releases must be compatible with the large base of Mac software and at least a majority of existing Macs. The large installed base, which made the company so solid, has become a chain around Apple's neck. Difficulties surmounting this problem are making implementing even the limited multitasking of its System 7.0 a long and tortuous process. In addition, applications written for the Mac must also work, by and large, on most of the installed machines, lowering the common denominator the developer can assume for raw hardware power.

**Custom development.** But commercial developers don't make up the whole story. Corporate developers as well as vertical-market consultants and VARs will be a large and important part of NeXT's competitive advantage in software. I'm talking here about VAR applications built from scratch. Examples include video-store management systems and front ends for large medical diagnostic machines. With NeXTstep, they've got the best environment around for custom application development.

Custom software has always been a major activity in American business. This is not a new development. Most large mainframe packages are designed to be modified and customized by companies. But the NeXT will provide another kind of custom-made software: a core product sold commercially that can be customized by a consultant or the developers themselves. A successful example of this is the custom system for the NeXT written by Adamation for the William Morris Agency, featured in "The Star System" in this issue. Building on the core of Who's Calling?, Adamation has left open multiple hooks for custom developers to hang specialized applications on. Instead of just a general package for client-contact management, you have a client-contact system tailored for a talent agent.

Developing a user interface in NeXTstep requires a modest investment of time and a short learning curve. The object-oriented environment allows for easy connection to the system's and other programs' resources. This frees the customizer to develop more expertise in solving the problem at hand, rather than spending all his or her time becoming an expert in programming. Equally important, however, is the ability of a NeXT customizer to develop rapid prototypes and reiterations. For the first time in microcomputer history, the client is a true member of the development team because the ease of using NeXTstep and the rapid turnaround time makes user input feasible. These advantages help produce excellent custom apps and give the client significant savings of time and money through shorter development cycles.

NeXT thus has a clear advantage over Sun and Apple. While Sun has always used custom applications as its calling card, its environment suffers because of its original design. Since Sun development is more natural in science and engineering, the development environment was not planned for a general audience. And because Sun built its development interest around UNIX, it is extremely vulnerable to those that add even more value to UNIX—such as NeXT.

Apple has tried to enter this market as well. Since the normal Apple development environment was too difficult and long term for rapid custom development, HyperCard was pressed into service. HyperCard was originally designed as an end-user tool. Putting HyperCard to work for corporate development meant using it primarily as a front end to more powerful applications. Though it has had some success in this area, users often bump up against the limits inherent in its original design. Again, the Apple PC, also known as the Macintosh, struggles against a ceiling that obstructs its entry into the PW market.

**Selling into new markets.** When all is said and done, however, NeXT's third competitive advantage will be distribution. Because the NeXT is a PC at heart it will be distributed like a PC, unlike some of its competitors. After distribution was discussed in our last issue, NeXT announced a new and expanded retail strategy. In addition to BusinessLand, Computer Attic in California has been authorized to sell the NeXT. Steve Jobs has publicly acknowledged a strategy that will use many independent dealers of NeXT products. This is both good news and a natural development—a PC should be generally available and especially available through retail stores. Further, NeXT software and peripherals are appropriate for mail-order mass marketers like NeXT Connection. These points are important because only through wide distribution can a PC be widely sold. The professional workstation will be the next natural product for the extensive computer retail infrastructure that is already in place around the country.

By contrast, the Sun is sold primarily through its direct sales force. That means of distribution is effective only for large accounts. Sun misses a whole universe of small purchases that make up an important part of the PC market and will be crucial in the PW market. Though Sun is moving to correct this situation, the Sun is inherently difficult to sell at retail because of its complexity.

The professional workstation market will be coming of age over the next several years. Unlike Sun, NeXT has the basic tools necessary to produce a machine for the masses. And unlike Apple, it has the power necessary for professional corporate use. It also holds a strong competitive position over both Sun and Apple with its system software and its potential for top-notch custom and mainstream applications. In short, NeXT is in the right place at the right time with the right products.

**NeXT Ink** *focuses a sharp eye on NeXT and its impact on the professional workstation market.*
**Dan Lavin** *is technology editor of* NeXTWORLD. *He can be reached at 415/978-3186 or e-mail dlavin@nextworld.com.*



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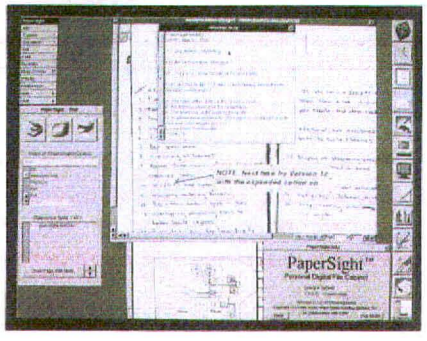


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# NeXTWORLD Interview: Al

**The authors of *Future Shock*, *The Third Wave*, and *Powershift* talk about the impact of technologies—and predict new ones.**

# Alvin and Heidi Toffler

The genesis of Alvin and Heidi Toffler's lifework can be found in their article entitled "The Future as a Way of Life," which appeared in a 1965 issue of *Horizon* magazine. Here they examined the need for long-range future planning in business and government and coined the term *future shock* to describe the disorienting potential of high-speed changes that were right around the corner. When the Tofflers detailed that new world of social and technological change in their 1970 book *Future Shock*, they instantly became international celebrities. Selling 7 million copies in 30 languages, this book became the starting point for discussions of our global future and the foundation of their futurist trilogy rounded out by *The Third Wave* (1980) and *Powershift* (1990).

Although Alvin Toffler is credited as the sole author of their many works, he insists that his wife, Heidi, has been his "unacknowledged coauthor" from the beginning. For 40 years they have lived, traveled, researched, and written together. The trilogy is the culmination of their research and thinking that began when they met at New York University in 1948.

After college, convinced that they needed "graduate study in reality," they moved from New York to the Midwest and spent five years experiencing America's smokestack industries firsthand. Alvin worked as a metal finisher on an auto-assembly line, operated a punch press, and became a millwright in a steel factory. Heidi made aircraft parts in an aluminum foundry, served as shop steward for the United Auto Workers, and helped organize protests against racial segregation. The Tofflers also began writing about these blue-collar experiences.

In the late 1950s, Alvin became a newspaper correspondent in Washington, D.C., for a Pennsylvania daily, covering Eisenhower's presidential press conferences and House and Senate hearings on everything from disarmament to antitrust problems.

After Alvin had covered labor issues as an associate editor for *Fortune* magazine for three years, the Tofflers were asked to write a white paper for IBM on the long-range organizational implications of the computer and white-collar automation. This was followed by a study on information retrieval for the Educational Facilities Laboratories, which sent the Tofflers around the country interviewing researchers in the field of artificial intelligence. Xerox Corporation hired them to prepare a paper describing advanced work on imaging technology. Research for a foundation study of the economics of the arts in America became the basis for their first book, *The Culture Consumers* (1964).

Since the extraordinary reception of *Future Shock*, the Tofflers have spent increasing amounts of time meeting with world leaders and studying the influence of technological change internationally. Other books include *The Eco-Spasm Report* (1975), *Previews and Premises* (1983), and *The Adaptive Corporation* (1985). In 1986, they joined James Baldwin and Arthur Miller to establish the first non-Communist, nongovernmental organization in the Soviet Union, the Issyk-Kul Forum, an international assembly of intellectuals that discusses social and economic questions.

*Future Shock*, *The Third Wave*, and *Powershift* interrelate and repeat ideas in different forms. *Future Shock* looks at the process of change. In it the Tofflers argue that the acceleration of history by technology will bring us out of the smokestack culture much faster than industrial machinery brought us out of the agrarian culture, and that the process will require major social and economic adjustments. *The Third Wave* deals with the specific directions that process is taking us and how developing industries based on computers, biotechnology, and new electronic media will affect future societies.

*Powershift* argues that we can no longer cling to outdated power structures of brute force and monetary wealth in the information age and presents a theory about who will control the process of change in the future. Within this theme, the Tofflers explore the central role that the computer will play in every aspect of our future lives. This is what we asked them to discuss with us.

The Tofflers were interviewed by Digby Diehl, daily book columnist on the Prodigy computer network, regular contributor to *Playboy* magazine, former book editor for the *Los Angeles Times*, and author of *Supertalk*.



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"There is the beginning of a whole new techno-political fusion of technology and politics. It's a fundamental historical change."

—Alvin Toffler

*NeXTWORLD: How do you see the computer itself changing?*

**Alvin Toffler:** The computer is being embedded in everything: in our automobiles, in our steam ovens, and in our factories. It is the ultimate tool of the age, and for this reason, the social impacts are ramified widely, and sometimes are contradictory. We've always said that we still think of computers as plastic or metal boxes with keys on them and a metallic or technical feel about them. Computers in the future are going to be friendly, customized for each individual. And I believe—and perhaps Heidi will shudder at the thought—that they will be implanted inside our bodies.

**Heidi Toffler:** I do shudder at that thought.

**AT:** I think that they will not only be implanted to compensate for some physical defect but eventually will be implanted to enhance human capability. The line between human and computer at some point will become completely blurred.

*NW: Before Heidi poob-poobs this idea, let me pursue it for a moment. It's a very exciting idea.*

**AT:** It's a frightening idea as well. We're going off into the realm of science fiction a bit. Imagine people going around with microprocessors or tiny little computers inside them and then somebody spreads a virus. We can imagine all sorts of strange permutations of all of this, but it seems likely that we will move in this direction—and that it will have, like everything else, both positive and negative effects.

**HT:** It adds fuel to the fire of those people who hate technology and who want to go back to an idealized pastoral past, which never existed in the first place. It is the ultimate threat of combining technology, which they hate, with human beings. But I don't see that this is going to happen. What I see the computer being used for is just a part of your everyday life.

Just think: Ten years ago, who would have conceived of faxes all over the place, and cellular car phones? I think the same thing is going to happen with the computer. You're going to be able to talk to it. And you're going to be able to ask it to remember things or to do whatever you want done—your bookkeeping, your bank statement.

**AT:** A computer is going to become more like a television set. And a television set will become more like a computer, in every size, from hand-held to Wall Street mainframe. As I say, they are going to perform many, many things, although you will need fiber optics for interactivity. For example, the French government has distributed 5 million terminals, called Minitels, to people to use in lieu of a phone book, but there are 10,000 uses that you could access through this little terminal, whether its banking, or e-mail, or communicating with friends. Your house is not going to have a television set—it's going to have maybe a dozen television sets. It's just a question of whether we're talking about 5 years or 10 years or 20 years.



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*NW: The changes are so rapid, it's hard to keep up. When I rush out and buy my first telecomputer, will it be obsolete in six months? We've heard about planned obsolescence in cars, but now we're talking about ideas.*

**AT:** Yes, here the obsolescence has gone from the hardware to the software. What's happening is that some of the machines are becoming overfilled with bells and whistles that we don't need for a particular job. What will happen is extreme customization; no two computers will be the same. We're going to have machines so personalized that they respond to *our* voice but not to somebody else's. Computers will have learned our every little idiosyncrasy. They will know that we characteristically mistype *square* as *sugare* and will automatically correct for that. They will have learned what we order for lunch. They will be our alter egos. The idea of commodity computers, which are the same for everybody, will become passé. Some may be useful for certain industrial purposes and functions, but at a personal level—the ultimate end toward which we are heading—will be machines that can learn and get to know us and, therefore, serve us in highly individualized ways to such a point that we'll be serving them!

*NW: You don't seriously think we'll get to the point where we'll be serving them?*

**AT:** Well, I don't think we're stupid enough to allow things to go to that point.

*NW: What happens when we begin to take the ubiquity of the computer for granted?*

**HT:** We tend not to think about the secondary or tertiary effects of any technology introduced. Take the example of the automobile, which has tremendously altered society. Just the given fact of mobility altered the way people lived. But when we started using cars, we never thought of that. It changed people's sex lives, it changed their family lives, it changed their working habits, it changed the way they organized cities.

*NW: Already the computer has begun to do that.*

**HT:** Yes. We're shooting a show on *Powershift* for Japanese television, and one of the countries we shot in was Israel, where there is a cutting tool factory that doesn't have a single worker in it. Even the machines get their parts from a robot that goes from machine to machine and resupplies them.

**AT:** Imagine a vast library with stacks three or four stories high and a robot that selects volumes and plugs them into different machines; that's what they have, in effect. It is truly startling. One factory could do something like make a measurable fraction of the world's supply of cutting tools. What's really interesting about this experiment is it's being run by a visionary father and son who see their function not as making cutting tools for the world, or profits. Their primary purpose is social—to develop the region around them, the Galilee region.

**"We are now deep into the stage of what we call cultural technology, in the sense that these machines, these new generations of computers, affect culture at the deepest levels."**

**—Alvin Toffler**



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They've started what they call an incubator community, in which people with ideas for new products come to them. They will help these tiny little companies get started. The idea is to build a community that will be economically viable, that will be a major export platform for this tiny country that doesn't have a large internal market. And, hopefully, one in which Arabs and Jews will work together. It's a breathtaking vision based on the application of computer-driven technology.

*NW: Let me ask the question that always comes up when you talk about robotics. What do the people do?*

**AT:** The company employs several hundred people all told, and they are mostly technical specialists or they are tracking invoices; they are businesspeople.

**HT:** Stop a minute and think about today in the United States, how many people actually handle physical goods. Al and I both worked in factories for five years. Most of those jobs don't exist anymore. The light bulb factory that I worked in, I am absolutely convinced, is now totally automated. There was no need for a human being to do the kind of dehumanizing work that I did for a year. I held a bunch of filaments in one hand and a tweezer in the other, and I filled slots that are the equivalent of gas jets. It made me into a robot. I'm grateful that kind of job is gone.

**AT:** When we were at the White House, we met with former President Reagan, Chief of Staff Regan, and Bush. There was a group of us futurists sitting around. Regan said, "Oh, what you people are saying is that America is not going to be a great manufacturing power anymore. That we're all going to be clipping each other's hair and shining each other's shoes." Heidi said, "No, you're wrong; we will be a great manufacturing nation, it's just that we won't need very many people to do the manufacturing."

The outlook and long-term direction is clear: People with highly developed skills and backgrounds will get paid more and more and more, and will work under better and better conditions and have more power vis-à-vis their own managements. On the other hand, people with inappropriate skills will find it harder and harder to gain even a foothold in the economy. This is a polarization that is very dangerous.

*NW: Our society, to a large extent, is already split as you describe. In your estimation, will the computer make a dent or make a difference?*

**HT:** It depends on how the computer is used. If it's used as an adjunct to the rote and repetitive kinds of learning that have occurred in the schools in the past—in order to take standardized multiple-choice tests—then the computer is almost irrelevant, or even destructive, in the classroom. But if it is used to teach people to think better, or to think at all, then it's a valuable learning tool.

**AT:** We don't teach skepticism [in the schools]. A degree of skepticism is healthy for a normal society, and particularly for a computerized society. This

**"We will be a great manufacturing nation, it's just that we won't need very many people to do the manufacturing."**

**—Heidi Toffler**



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takes us to the theme of *Powershift:* Those in power have always used information games, propaganda, lies, secrets, deception to stay in power, and it's certainly true today. What's new is the introduction of the computer.

The computer, on one hand, provides citizens with fantastic amounts of hitherto secret information. But at the same time that there's more data available, the games have become more sophisticated. Now political policymakers fight over not just the facts of the situation but the scientific models being used to decide the questions. So, for example, [presidential advisor John] Sununu can question the computer-generated models being used to state the conclusions. Senator [Albert] Gore, on the other side, can also question the validity of the model. Suddenly what's happening is policy is being fought over at the meta-level of models. Is the model good? Is the model bad? Most people don't know what a model *is!*

*NW: Something Heidi said early on is germane to what we've been discussing about education, politics, and so forth—that the form of the computer is going to change to allow a more accessible interface, that the human interface will reach the point of responding, say, to the question: What is this model Sununu is talking about? and then referencing different data and explanations about what a model is and other background information.*

**AT:** Imagine a political system in which candidates submit an interactive disk to you that you put into your television set. It asks if you want to see candidate Brown (a) deal with a crisis, (b) reorganize the bureaucracy, or (c) make tradeoffs on taxes. You press button A and see a dramatized crisis in which he is compelled to make decisions. But you have the capability of changing the terms of the crisis, so that you can actually see how he might respond. You form your own judgment about whether this candidate is capable of coping with a significant crisis. With this kind of technology, the politics of the future could be fantastically different from anything we know today. There will be incredible political technologies coming down the line, all of them impossible without computers.

The other thing that needs to be said about computers is that we're past the stage of information technology. We are now deep into the stage of what we call cultural technology, in the sense that these machines, these new generations of computers, affect culture at the deepest levels.

For example, automatic translation. When you begin making languages transparent to one another, you make a given culture open to input from an outside culture in ways that are very subtle but that can have enormous long-term implications. But individual technologies don't do much by themselves. You've got to see them in relation to other technologies, seeing automatic translation, for instance, in relation to satellites—cheap satellites in which the electronics are the size of a pack of cigarettes. When you connect these widely available satellite dishes with automatic translation, you, in Silicon Valley or Patterson, N.J., are going to be bringing in television programs from Guatemala, Nigeria, Patagonia, India, from all over the world, and in a language you can understand.

Even things like producing a word processor that you talk to and that prints out your words. We know how to do it, it's just a question of cost. When this is widespread, we will begin to reduce the requirements of literacy.

**HT:** I've thought a lot about this, and I'm not sure what effect illiteracy will have on the world. That, to me, is one of the most fascinating questions of the future. For instance, we were in Egypt recently, and the Egyptians don't allow the word *secular* to be used. Now, if you don't have literacy and you don't use certain spoken words, you don't use those concepts. Now what do you do to a society if you eliminate concepts and words and all the people are illiterate?

**AT:** I think it's not just a question of literacy but of a change in the function of literacy. The Egyptians may eliminate the notion of secular from their language, but when those satellite translations come in from outside, these people are going to see things coming right in from Beverly Hills—and then they're going to know what *secular* means, for good or for evil.

Many jobs that today depend on literacy may no longer depend so heavily on it. I'm thinking of an airlines reservations clerk. The day may come when the computer provides a great deal of the information required by the clerk to do the reservation. Maybe it provides iconic images rather than just words.

*NW: But none of this is possible without computers.*

**AT:** And without the democratization of computers, which was introduced by the original Apple. What I mean is that computers are no longer giant monsters kept in a sealed room with white-coated guardians. Freed from this, they spread throughout the company and throughout society. It's not just governments and companies that can afford these things. We also know that computers and computer networks are being used by all kinds of protest groups, from the Ku Klux Klan to the far Left. So there is the beginning of a whole new techno-political fusion of technology and politics. It's a fundamental historical change.

**HT:** One of the big social and psychological questions of the future is a values question of how we prefer to be changed or not to be changed.

**AT:** All of the things that were science fiction have become at least mechanically possible. In the past, when technological options were few, societies generally chose their technologies based on one of two questions: Is it something people want and could you make a profit off it? or Does it enhance military power so that the state wants it? Today, there are so many alternative technological options flooding out of our laboratories around the world, it is impossible for us to fund them all, and we need far more constraining criteria for their selection. The technological questions go beyond the bang and the buck. They need to be shaped by social input.



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# Profile: Adobe on Display

In the top photo, John Warnock (in jacket) confers with Adobe developers (clockwise from top left) Bob Wells, Chris Hunt, Linda Gass, John Carnes, Gordon Hamachi, and Jim Sandman.

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**Together, Adobe and NeXT bring true WYSIWYG to the screen.**

by Elizabeth Weal

The company that invented PostScript and played a critical role in the early acceptance of the Macintosh has also taken on a significant role in the future of the NeXT. Adobe Systems pioneered Display PostScript—the imaging model that affords users true WYSIWYG (what you see is what you get) display capabilities—which first appeared on NeXT computers. Soon, Adobe will also bring over its popular illustration application, Adobe Illustrator.

The PostScript page-description language has become a de facto standard for electronic printing and publishing. More than 100 PostScript output devices are available, including black-and-white printers, color printers, typesetters, film recorders, and video production systems, with support for these devices provided by more than 4000 software products. In addition, Adobe's Illustrator and PhotoShop have earned the company a reputation of being a leading developer of graphics software, primarily for the Macintosh platform.

**Joining forces.** The cooperation between Adobe and NeXT is illustrated by the story of how Jack Newlin, a software engineer at NeXT who played a key role in implementing Display PostScript, got his job. In 1986 Newlin, who had been working at Xerox Palo Alto Research Center (PARC) for almost ten years, visited Adobe to meet with some former colleagues from Xerox—including Adobe cofounders John Warnock and Chuck Geschke—and to ask about the possibility of a job. Adobe told him that his work at Xerox on Interpress, a language similar in many respects to PostScript, made him ineligible for employment.

"They said, 'We'd be risking a lawsuit if we hired you,'" Newlin recalls. Warnock did, however, ask Newlin if he'd be interested in learning more about a start-up that was doing interesting work. Newlin said that he would. An hour later, when Newlin was back in his office at Xerox, the phone rang. The voice at the other end announced, "Hi. This is Steve Jobs."

Newlin met with Jobs and soon became an employee at NeXT. His first project was working with software engineer Leo Hourvitz to integrate Display PostScript into the NeXTstep environment.

Adobe and NeXT joined forces to develop Display PostScript on the NeXT soon after Steve Jobs had founded his new company in 1985. However, the history between Jobs and Adobe goes all the way back to the initial stages of Macintosh development, when Jobs abandoned development of a letter-quality dot-matrix printer inside Apple and chose, instead, to develop a PostScript printer in conjunction with Adobe.

Together—with the important link of Apple's LaserWriter printer—Apple and Adobe prospered. The high-quality output available from PostScript printers was a key factor in winning the Macintosh its coveted position as the preeminent desktop-publishing platform—which essentially created a whole new market for microcomputers. Adobe, in turn, received 80 percent of its early revenues from sales of the LaserWriters.

It's not surprising to find that when Jobs started NeXT, he turned to Adobe. "I think we have a similar view of the world and similar goals and aspirations, so it's hard to imagine not working closely with Steve," says Warnock. But Warnock's decision to support the NeXT is based on more than personal compatibility. "The NeXT really is a very strong indication of where the industry should go," he states.

**Displaying talent.** When Adobe began licensing PostScript, the technology was used exclusively for describing output from devices such as printers and typesetters. NeXT was the first company to license Display PostScript, an extension of PostScript that defines what appears on the screen.

The notion of using a machine-independent graphics language like Display PostScript to drive a monitor actually predated the implementation of a device-independent rendering language on printers. In the mid '70s, while Warnock was working at Evans and Sutherland, he designed a device-independent graphics language for use in an application for teaching ship pilots how to steer through New York Harbor. When he later worked at Xerox PARC, he implemented a similar graphics language, called JAM, that was also screen-oriented.

The graphics available on the minicomputers that Warnock used at Evans and Sutherland, and at Xerox PARC, were not possible on the Macintosh. The original Macs had neither the power nor the speed necessary to drive a display with such a complex language. (The Macintosh screen-imaging language is called "QuickDraw.") It was possible, however, to install the computing power required to generate PostScript output into a printer.

"Jobs's experience on the Mac made it clear that it is beneficial to have the same imaging model on the display as on the printer. So, when he founded NeXT, he knew he wanted PostScript for his display, in addition to having it for his printer," says Linda Gass, engineering manager of Display PostScript at Adobe.

"It's a real problem for application developers who develop in an environment like the Macintosh or Windows to have one graphic-imaging model drive their display and then need to go through a tedious process of translating the graphics that they've used for the display into what the printer is going to understand," explains Gass. The translation causes a headache for users, too, who must wait out the processing time before the printer spits out a page. And even then, the result may not be exactly what they expect. "It's like trying to translate French into English; it's possible to do it, but it's hard, and the meaning is often lost in the translation," Gass adds.



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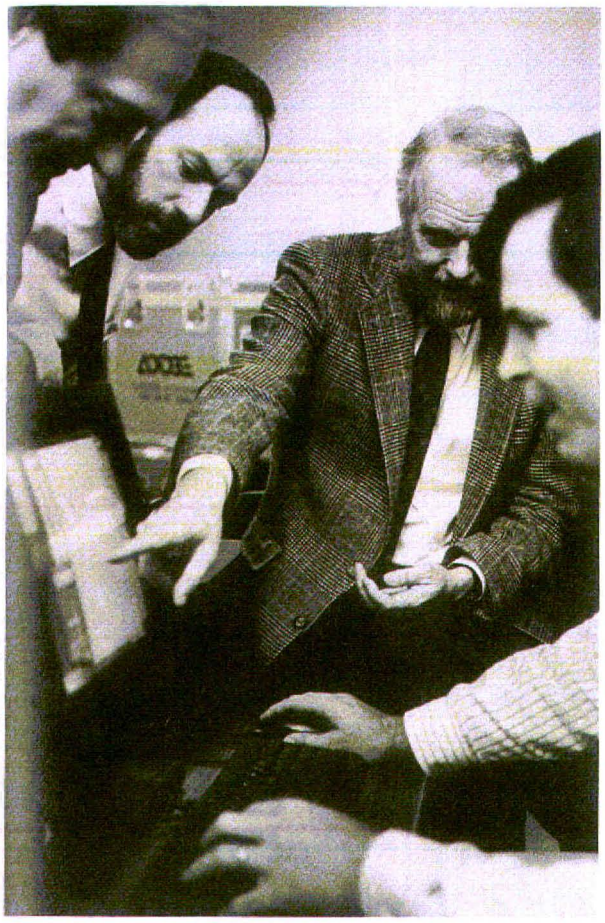

### Adobe Systems

**Location:** Mountain View, California

**Founded:** 1982

**Revenue:** Fiscal 1990: $169 million

**Employees:** 500

**Product:** Display PostScript, an implementation of PostScript that provides true WYSIWYG on the NeXT display

**Time in development:** Two years

**Number of engineers on development team:** Fluctuated between four and eight

**Current projects:** A NeXT version of Adobe Illustrator

According to Gass, two factors contributed to Adobe's decision to implement Display PostScript on the NeXT. First, workstation hardware had evolved to the point where it was practical to develop an interactive PostScript interpreter to drive the display. Second, Adobe had a customer. In the combined Apple-Adobe effort to develop Display PostScript for the NeXT, Adobe's task was to extend PostScript so it could handle imaging in an interactive environment. NeXT's role was to integrate Display PostScript into the Window Server of the NeXTstep system software and to provide Adobe with ongoing feedback about Display PostScript's performance.

The terms of the joint development effort between Adobe and NeXT were laid out in a contract that stipulated, among other things, that the developers were not permitted to view certain highly proprietary parts of each other's source code. Both sides agree that the development effort went smoothly and that the two teams complemented each other well, although the "secret sources"—as they came to be called—made things a bit dicey when it came time to debug.

"Sometimes a bug in their code would only be in evidence in our version, so it would be hard for Adobe to find the bug in the privacy of their own facility," Newlin recalls. In such cases, Adobe engineers had to go to NeXT headquarters, secret sources in hand, and attempt to reproduce the problem there.

Newlin and Hourvitz did most of their development work at NeXT, but they spent ten weeks at Adobe during a critical period in the project. Because NeXT wanted to keep all specifications about its new machine under wraps, Newlin was instructed not to tell outsiders of his whereabouts. "I remember riding my bicycle to Adobe from my house one day, when I saw an old colleague. It was an odd direction to be riding my bike, away from my house. We didn't stop and talk, but I waved to him and went on and thought, 'Hmm. I wonder what my excuse is for riding in this direction.'"

Adobe's cooperation with NeXT led to other victories for the company. Many of the enhancements that Adobe added to PostScript to create Display PostScript were incorporated into PostScript Level 2, a PostScript extension announced last June. Other enhancements in PostScript Level 2 include support for device-independent color, forms and patterns, and composite fonts (like Kanji, a font with large character sets); data and image compression; and performance improvements.

**Other platforms.** Some day, workstation users will take for granted that what appears on the screen is identical to what prints out on the printer. Today, however, it's still common to find discrepancies between the two. From a user's perspective, the benefit of Display PostScript is that it guarantees consistency. The NeXT's electronic fax also transmits in PostScript code, which produces output that is far superior to output from a scanned fax document.



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**"We did Illustrator for the NeXT for the same reasons we did Illustrator in the first place. On the Macintosh, Illustrator is a useful tool and demonstrates the power of PostScript on PostScript printers. On the NeXT, it's a useful tool and showcases PostScript on the display."**

**—Jim Sandman**

Several companies besides NeXT license Display PostScript from Adobe. Digital Equipment Corporation, for instance, distributes it with all Ultrix (DEC's version of UNIX) and VMS workstations. IBM supports it on the RS6000 (IBM's RISC workstation). Silicon Graphics recently announced plans to license it, too. NeXT is the only system, however, that has implemented Display PostScript from the ground up.

Warnock compares the Display PostScript implementation on the NeXT to the implementation on Motif, the Open Systems Foundation's user-interface standard. "Display PostScript under Motif is sort of an adjunct graphics package. You can use the Motif graphics package, or you can use Display PostScript," he explains. "In the NeXT machine, it's all integrated very tightly and consistently." On the NeXT, Display PostScript is fully integrated throughout the machine's operating environment.

**Illustrator.** Adobe's links with NeXT continue, as Adobe brings its Illustrator software to the platform. This key addition to NeXT's software offerings—an anchor in the desktop-publishing portfolio of the Macintosh—is scheduled for delivery this quarter.

"We did Illustrator for the NeXT for the same reasons we did Illustrator in the first place," says Jim Sandman, a member of the Display PostScript development team. "On the Macintosh, Illustrator is a useful tool and demonstrates the power of PostScript on PostScript printers. On the NeXT, it's a useful tool and showcases PostScript on the display."

Developing Illustrator for the NeXT was also a financial consideration. If Illustrator is successful on the NeXT, Adobe will profit in two ways: direct revenue from Illustrator, plus indirect revenue from the increased sales of the NeXT that the presence of this key software is bound to initiate. Adobe receives royalties from the Display PostScript license.

Four programmers make up the NeXT Illustrator team. Original team member Bob Welles becomes exuberant when he describes the NeXTstep development environment. "It's wonderful," says Welles, sporting a grin reminiscent of a kid who has just been handed a stack of rare baseball cards. "People who developed the NeXT windowing system knew what was wrong with the Macintosh windowing system and then went on to solve all its problems. The result is a more powerful system. I mean power in the sense of how much a call to the windowing system will accomplish. On the Macintosh, you have to write a lot of code to do very simple things. On the NeXT, you write less code to get the same amount of work done."

Welles cites the example of creating scrolling windows, a process that, on the Macintosh, requires developers to go through several tedious steps. On the NeXT, all one needs to do is define the scrolling window and its contents. "When you create a high-level scheme like that, you're really taking the risk that you're going to prevent someone from doing the thing they need to do. But NeXT has thought things through well enough so that that doesn't happen," he says.



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Adobe began developing NeXT Illustrator on the NeXT computer about two and a half years ago. During the relatively long development cycle the team has been redefining the program's user interfaces so that they can easily be ported to a variety of platforms and user interfaces, such as Microsoft Windows and Sun Microsystems' X Windows.

The work has been complicated because the original Macintosh Illustrator source code, Illustrator 88, changed substantially during the course of the project, culminating in the release of Illustrator 3 for the Macintosh at the end of last year. New features in Illustrator 3 will appear in the NeXT version, including the ability to include arbitrary-length text blocks with any mixture of typographic styling, to fill any sequence of shapes with type, and to place type along a path. In addition, Illustrator 3 promises editable font outlines, an easier-to-use user interface with more feedback to the user, alignment aids, a graphing tool, and a direct select tool that permits selecting and manipulating portions of groups without ungrouping them.

Adobe has not announced any features that will be unique to NeXT Illustrator, but members of the development team say that certain standard features of the NeXT computer—including the large display; grayscale display; and services such as e-mail, fax, and the spelling checker—make the software particularly well suited for the NeXT platform.

**On the crest.** Despite some gloomy economic forecasts for the computer industry, the mood at Adobe remains upbeat. Some alarms sounded when Apple and Microsoft announced plans to produce a PostScript clone, but the language, called TrueImage, has yet to be adopted by any Adobe customers. Meanwhile, Adobe's revenues continue to climb.

Perhaps most important, Warnock, the company's resident visionary, shows no sign of slowing down. His latest inspiration is to use PostScript as the basis for a kind of electronic paper that is independent of the software on which it is developed. "Communication of documents across platforms is going to be very important in the future. But for that to happen, the document has to be somewhat self-contained so that it doesn't depend on attributes of lots of different operating systems," Warnock says. "You can imagine having a computer-generated document that could go across all different operating systems and platforms and could be viewed on that platform and printed from that platform." With this in mind, it's possible that PostScript may be the ASCII of the '90s.

**Elizabeth Weal** *is a free-lance writer in Palo Alto, California.*

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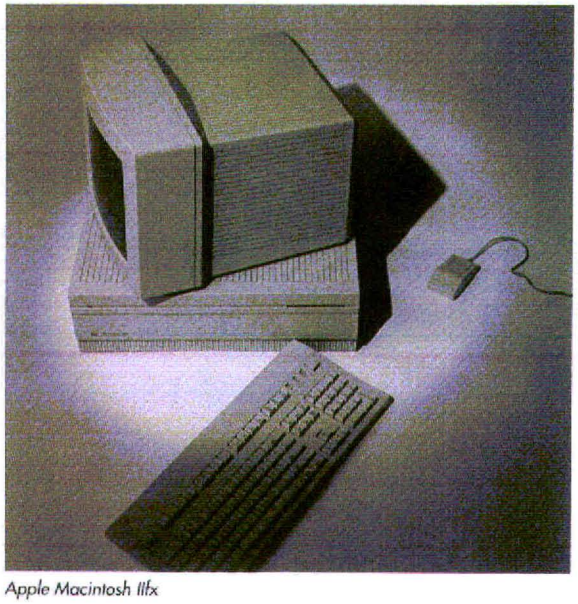
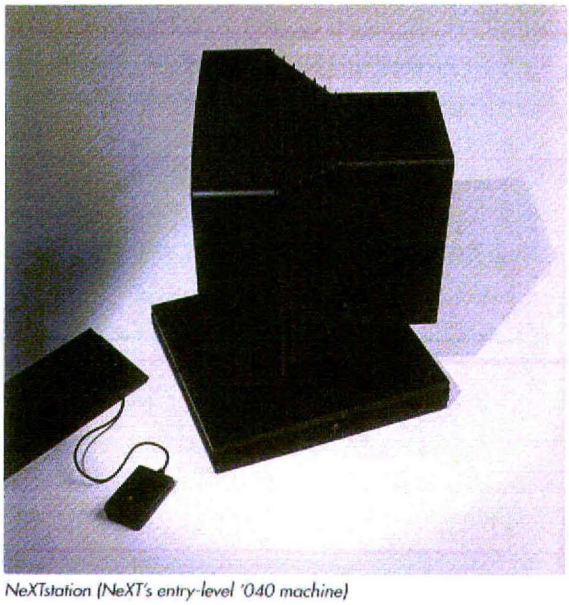
# Station to Station



Apple Macintosh IIfx



NeXTstation (NeXT's entry-level '040 machine)



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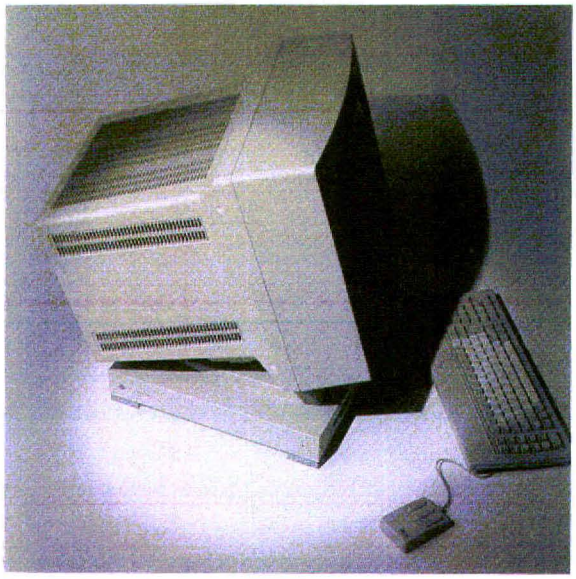
**The new NeXT '040 machines square off with the Mac IIfx and SPARCstation 2.**

by Edward Jung and Bruce F. Webster

A curious hole in the micro/workstation marketplace has appeared in the last year or two—a gap created by the simultaneous upward reach of Apple's Macintosh product line and the downward thrust of the Sun family of workstations. The two trends don't meet squarely, but rather pass to the side of one another, leaving a space between them. And although some borrowing has gone on between Apple and Sun, that space may have remained unfilled for some time—were it not for NeXT.



*Sun SPARCstation 2*

The revised lineup of NeXT systems, introduced in September 1990, falls squarely into that breach separating Apple and Sun. The computers themselves—the NeXTstation, the NeXTstation Color, and the NeXTcube (with or without the NeXTdimension graphics board)—borrow the best of their neighbors' attributes, with some enhancements of their own.

With this article, *NeXTWORLD* begins an ongoing series whose intent is to provide a meaningful and hard-nosed evaluation of how NeXT and its computers stack up against the competition. The three platforms we look at here are competing for a market we call the professional workstation market. It includes such people as DTP specialists who need to work intensively with color, engineers who want to use the same computer for their computation-intensive work that they use for their in-house newsletters, financial analysts who want the latest analytical powers of Improv and a customized environment for building links to high-end databases. The group is defined by a need for the highest-powered desktop systems it can get.

This article provides a general overview of three competing products: the NeXT '040, the Sun SPARCstation 2, and the Macintosh IIfx. We're not here to decide for all time which is the "best" of the three systems, a question that is moot outside of a given customer context. We're here to see how representative systems from each company compare in design, features, utility, value, and performance.



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## ALL IN THE FAMILY

Each of the three product families—Sun, Macintosh, and NeXT—has its origin in a single system based on a Motorola 680x0 processor. For Sun Microsystems, it was the Sun 1, introduced in 1982 and using a Motorola 68000 CPU. Sun was intended from the start to run a version of Berkeley's UNIX, providing a relatively low-cost solution for academic and engineering environments looking for UNIX-based personal workstations. The product line divided in the late '80s: Sun-2s and Sun-3s used 680x0 processors, the Sun 386i's used Intel's 80386 CPU, and the SPARCstation models used a custom RISC (reduced instruction set chip) processor called SPARC (Scalable Processor ARChitecture) for greater performance. At the same time, the market expanded greatly, with Sun placing systems in a wide variety of settings; with a total installed base of some 500,000 systems, roughly half are SPARCstations. During the last year or so, Sun has discontinued the 680x0- and 80386-based systems and is focusing on expanding the SPARCstation product line. Sun expects to sell some 200,000 SPARCstations this year. Of their personal workstations, the newest and most powerful is the SPARCstation 2.

For Apple, it was the original 128KB Macintosh, using an 8MHz 68000 CPU and released in January 1984. Unlike Sun, Apple positioned the Mac as a personal computer, touting it as "the computer for the rest of us." One could argue that, until recently, Apple's pricing policy made it "the computer for the rich of us." But it is also true that the Macintosh opened up personal computing for large numbers of people put off or confused by the arcane nature of most computer systems. The Macintosh product line has grown and shrunk over the years, with several models appearing and then disappearing. The total installed base is roughly 4 million systems. The current Macintosh product line runs from the wildly successful Mac Classic—which uses the same 8MHz 68000 CPU as the original Mac, and which may become Apple's all-time best-selling computer, eclipsing even the Apple IIe—to the high-powered and high-priced Macintosh IIfx.

NeXT introduced its first offering in October 1988 and started shipping it to developers and universities in December of that year, with commercial deliveries starting in September 1989. Combining a high-quality graphical user interface with a version of UNIX, it was, if you will, the first UNIX workstation for the rest of us. NeXT's original market was education, and an advisory board comprising representatives from over a dozen major universities did much to shape the product. The first NeXT system used a 25MHz 68030 CPU, a 25MHz 68882 floating-point processing unit (FPU), and—in a move still unique in the micro/workstation market—a 25MHz 56001 digital signal processor (DSP). Despite all that horsepower—or, perhaps, because it raised people's expectations—the NeXT was criticized for its performance, and sales were slow, with perhaps 10,000 to 15,000 systems delivered.

In September 1990, NeXT replaced the original NeXT computer with a family of three systems, all sharing a similar architecture and nearly identical performance, and all costing a good deal less than the original. The NeXTstation, NeXTstation Color, and NeXTcube all use a 25MHz 68040 CPU (which contains a built-in FPU); the principal difference is that the NeXTcube has three expansion slots, while the NeXTstations have none. Response has been strong, especially to the lower-priced NeXTstations; NeXT expects that the total installed base by the end of 1991 should be between 60,000 and 75,000 systems.

Note then, that for this comparison, we used an '040 NeXTcube for testing and evaluation and for building our specification table on a system equivalent to the other two platforms. For purposes of benchmarks, however, it should be noted that the NeXTstation is nearly equivalent to the NeXTcube in all performance tests that do not involve the NEXTcube's NeXTdimension 32-bit color board—and for $5000 less than the cube.

## SYSTEM ARCHITECTURE

Table 1 gives a feature-by-feature hardware comparison of the three systems. Each product represents its manufacturer's attempt to boost performance to the maximum, usually through a combination of processing power, caches, and input/output channels.

## PROCESSING POWER

The Mac vs. Sun debate is a classic case of CISC (complex instruction set chips) vs. RISC (reduced instruction set chips). CISC processors support complex instructions that perform a lot of work but can take many clock cycles to complete. RISC processors support simple instructions that don't do much work but take only one or two clock cycles to complete. Common wisdom has it that a RISC processor will beat a CISC processor running at the same clock rate, and that's certainly the case when comparing a 40MHz 68030 with a 40MHz SPARC chip set.

The NeXT's 68040 processor represents Motorola's attempt to close the gap between CISC and RISC. Motorola claims an average cycles-per-instruction rate of 1.3, which it achieves through a high degree of pipe lining (decoding several instructions at the same time) and tight integration of the integer, floating point, and memory management units (all on the same chip). Motorola also claims that a 25MHz 68040 outperforms a 25MHz SPARC chip and is about three times faster than a 25MHz 68030.

To help boost performance, many computer systems include a floating-point unit, a processor that specializes in high-speed mathematical operations using floating-point or real (non-integer) numbers. The SPARCstation 2 has a 40MHz floating-point SPARC processor in addition to the standard CPU, while the Macintosh IIfx comes with a Motorola 68882 FPU. The NeXT, however, has no separate FPU because the 68040 has a FPU built into it. This degree of tight



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*Table 1*

# Brief comparison of system architecture

| FEATURE | Macintosh IIfx | SPARCstation 2 | NeXTcube |
|---|---|---|---|
| **Main processor** | 40MHz 68030 | 40MHz SPARC | 25MHz 68040 |
| **Floating-point processor** | 40MHz 68882 | 40MHz SPARC FPU | (Within 68040) |
| **Digital signal processor** | None | None | 25MHz 56001 |
| **Chip cache** | 256 bytes (code, data) | None | 4096 bytes (code, data) |
| **External cache** | 32KB write-through | 64KB write-through | None |
| **On-board memory** | *1MB to 32MB | 16MB to 32MB | 8MB to 64MB |
| **DMA and I/O processing** | **SCSI DMA support | Full DMA support | Full DMA support |
| | **2 serial I/O processors | | 9 I/O processors |
| **On-board video** | No | Yes | Yes |
| **Expansion slots** | 6 | 3 | 3 (+1 for motherboard) |
| **Bus** | NuBus (10 MHz) | SBus (20MHz) | NeXTBus (25MHz) |
| **Network hardware** | LocalTalk | Ethernet | Ethernet |
| **Maximum transfer rate** | 230.4 kbits/sec | 10Mbps | 10Mbps |
| **Connector(s)** | DIN-8 (uses serial port) | 15-pin | BNC and 10BaseT |
| **PORTS** | | | |
| **Network** | (Uses serial) | DB-15 (thick-wire) | BNC (thin-wire) |
| | | Transceiver available | 10BaseT (twisted-pair) |
| | | For BNC, 10BaseT | |
| **SCSI** | SCSI (DB-25) | SCSI-2 | SCSI-2 |
| **Serial** | 2 RS-422 (DIN-8) | 2 RS-423 (DIN-8) | 2 RS-423 (DIN-8) |
| **Printer** | (Uses serial) | (Uses serial) | Dedicated printer port |
| **Video** | None | Dedicated video port | Dedicated video port |
| **Other** | Apple Desktop Bus (2) | None | Dedicated DSP port |
| **SOUND I/O** | | | |
| **Input** | Third-party hardware | Built-in, 8-bit, 8KHz | Built-in, 8-bit, 8KHz |
| | | | Also, third-party via DSP port |
| **Microphone** | None | None | Built-in (display) |
| **Sound generation** | Apple sound chip | SPARC (CPU) | 56001 DSP |
| **Output** | Internal speaker (system) | Internal speaker | Internal speaker (display) |
| | Stereo mini-jack | Monaural mini-jack | Stereo mini-jack |
| | | | Dual RCA line-outs |

***Version 6.0.x of Macintosh operating systems limited to 8MB, maximum.**

****Not supported by Version 6.0.x of Macintosh operating system.**



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integration allows for higher performance and lower cost. Motorola claims a sustained performance for a 25MHz 68040 of 3.5 million floating-point operations per second (MFLOPS), while Sun claims 4.2 MFLOPS for its 40MHz SPARC FPU. By Motorola's estimate, the 40MHz 68882 in the Mac IIfx should perform at just under 2.0 MFLOPS.

What the NeXT offers that the others don't is the Motorola 56001 digital signal processor. This chip is designed to perform key tasks very quickly in signal analysis, array processing, music synthesis, and CD-quality sound digitizing (with an external hardware interface via the DSP port). The potential of the DSP lies largely untapped at present, and may never be critical (or even useful) in mainstream applications, but it does give the NeXT a leg up in various niche markets, including the yet-to-materialize multimedia arena. And while a 40MHz SPARC chip can outperform the 56001 DSP chip in many signal processing applications, having a separate DSP minimizes the impact of those applications on overall NeXT system performance.

## MEMORY

The memory figures in Table 1 all assume use of 1MB and/or 4MB surface in-line memory modules (SIMMs). Both Apple and NeXT offer parity memory options, which provide a ninth bit for each byte to be used for error checking. The desktop Sun models use parity RAM by default, while the tower models use nonparity RAM.

To improve performance, both the Mac IIfx and the SPARCstation 2 have write-through caches containing (respectively) 32KB and 64KB of high-speed static RAM. When the CPU accesses a memory location (for instructions or data), the address and contents are stored in the cache. Each time the CPU does a memory read, it first checks to see if the desired contents are already in the cache; if so, the CPU reads them from the cache and aborts the regular memory fetch sequence. When the CPU writes out to a memory location, it updates the cache if that location's contents are there as well (hence the term *write-through*).

The Macintosh IIfx and the NeXT both have "on-chip" caches, that is, caches built into their CPUs. The 68030 processor in the Mac IIfx has separate 256-byte caches for both instructions and data; the NeXTcube's 68040 has 4096-byte caches for each. The SPARC processor has no on-chip cache.

## MASS STORAGE

Sun, Apple, and NeXT all started out with different forms of removable mass storage, and all have since standardized on a single medium. Sun, going into the classic minicomputer market, went with tape drives. NeXT, seeking to pioneer a new medium, was the first (and so far, only) personal system to have a read/write optical drive as a standard feature. Apple, which likewise made a controversial choice, but a successful one, went with the 3.5-inch floppy disk drive. Both Sun and NeXT have since switched to 3.5-inch floppies, though, in an ironic twist, their disk formats are geared towards MS-DOS compatibility, not Macintosh. Macintosh disk formats are 400KB, 800KB, and 1.4MB; the Apple File Exchange program allows reading and writing of MS-DOS disks. The SPARCstation supports reading and writing of 720KB and 1.44MB MS-DOS formats, as do the NeXT systems; however, the NeXT disk drives also support a 2.88MB format, requiring special disks. But there is also an ease-of-use issue. To read or write an MS-DOS disk on a NeXT, you simply insert it into the floppy drive, and it is automatically mounted and shows up on your File Viewer. For the Mac, you must either first launch Apple File Exchange before inserting the disk, or you must have a third-party software product (such as DOS Mounter from Dayna) that will detect the MS-DOS format and mount the disk accordingly. On the SPARCstation, you have to insert the floppy, open a shell window, and type the command "mount /dev/fd0," which then mounts the floppy drive to the default directory /pcfs ("PC file system").

All three systems support internal hard drives as well. The SPARCstation 2 supports one or two 3.5-inch hard disk drives. The current maximum size listed is 207MB, though that will continue to go up as technology advances. The Macintosh IIfx supports a single 5.25-inch full-height hard disk drive. Apple offers sizes up to 160MB, though third-party vendors offer much larger drives. The NeXTcube has two mass-storage bays. The upper bay holds the floppy drive and one 3.5-inch hard disk drive (sizes include 105MB, 200MB, and 425MB), or one 5.25-inch hard drive (sizes up to 1.2GB). The lower bay can hold one 5.25-inch mass-storage device, either a hard drive (again, up to 1.2GB), an optical disk drive, or a CD-ROM drive. This means, for example, that you could configure a NeXTcube server with 2.4GB of storage. All three systems have SCSI ports, allowing additional external mass storage devices to be added. On the SPARCstation and the NeXT, these ports use the new and improved SCSI standard known as SCSI-2.

## VIDEO AND GRAPHICS

Apple and its third-party vendors offer a number of well-integrated graphics solutions for the Macintosh IIfx. If you wanted to, you could stick a different video card into each of the IIfx's six NuBus slots and have all six displays form one giant "virtual desktop." Most cards are designed to support either Apple's 13-inch (640 x 480) RGB monitor, or a third-party 19-inch (1024 x 678) monitor, though other options are available. Color models are either 8 bits (256 colors), using a color look-up table, or 24 bits (16.7 million colors), using direct RGB encoding. Many of the 24-bit cards now also come with built-in graphics acceleration. Other NuBus cards allow for image compression, display of input video on the Mac screen, and blending of external video with Mac-generated graphics.

The NeXT motherboard comes with built-in video, providing 256KB of separate video memory (VRAM) to support its 1120 x 832 x 2–bit monochrome dis-



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play. NeXT also offers (as an option) the NeXTdimension graphics board, which plugs into one of the other slots and provides an 1120 x 832 x 24-bit color graphics display. The NeXTdimension graphics board uses an Intel i860 RISC processor to provide graphics acceleration, comes with a C-Cube JPEG chip that supports real-time compression and decompression of video signals, and has NTSC and S-video input and output for displaying video input and blending video signals with computer-generated images. A single NeXTcube can support up to four displays: the motherboard's monochrome display and three NeXTdimension boards, all (as on the Mac) forming one large desktop.

Sun offers a wider and more powerful range of video options for the SPARCstation, ranging from a low-cost monochrome option (1152 x 900) to a high-powered (and expensive) 24-bit accelerated color system designed for 3D modeling and animation. All these options use one (or more) of the SPARCstation's three S-Bus slots. Unlike the Macintosh IIfx and the NeXTcube, the SPARCstation does not allow you to drive multiple displays with one system.

## THE OPERATING SYSTEM

Both Sun and NeXT use custom variants of a popular operating system: UNIX. Specifically, both SunOS and NeXT system software started out based on the Berkeley Standard Distribution (BSD) release, with both companies adding their own enhancements and modifications. SunOS 4.1.1, the current incarnation, has a number of AT&T System V features, as well as some of Sun's own additions. Sun's eventual goal is to transform SunOS into a version of AT&T's UNIX System V Release 4 (SVR4) with a number of Sun add-ons.

NeXT has based its operating system software on the Mach kernel, developed at Carnegie-Mellon University as an attempt to go back and clean up the bloated UNIX system architecture. The eventual goal is to have a clean and efficient kernel, a clean and efficient (but UNIX-compatible) file structure, and a high degree of BSD 4.3 compatibility.

While Apple is offering A/UX 2.0 (UNIX System V, with BSD 4.3 extensions), that is an option that has a relatively small market share. A/UX's main use is to help Apple land federal contracts that require POSIX compliance (POSIX being a government standard for operating systems). The vast majority of Macintoshes use System (MacOS) 6.0.x, where x = 1 through 7. There are many differences, both major and subtle, between MacOS and UNIX, but a few key ones come to mind: The MacOS has no virtual memory, no DMA, and no preemptive multitasking. System 7.0, due out sometime this year, should add virtual memory, but still leaves out many of UNIX's advantages. However, MacOS also leaves out many of UNIX's inefficiencies and weaknesses, not to mention its generally bloated nature: You can still create a bootable Macintosh system configuration on a single 800KB floppy, whereas a normal UNIX system configuration, complete with swapfile, will cheerfully eat up most of an 80MB hard drive.

*Table 2*

## Comparison of performance

| Benchmark (count) | | NeXT ('030) | Mac IIfx | NeXT ('040) | SPARC-station 2 |
|---|---|---|---|---|---|
| Sieve | (1000) | 39.5 | 19.9 | 15.6 | 7.3 |
| Sort | (2000) | 24.5 | 11.7 | 9.5 | 4.9 |
| Matrix | (50) | 39.0 | 25.1 | 16.4 | 5.8 |
| Float | (10,000) | 9.4 | 12.2 | 6.4 | 3.4 |
| Savage | (20,000) | 29.7 | 12.3 | 24.7 | 5.6 |
| Circle | (500) | 28.9 | 7.5 | 9.3 | – |
| Square | (1000) | 28.8 | 14.9 | 14.9 | – |
| Dhrystone2 | | 5,451 | 9,011 | 22,727 | 34,884 |

**Compilers**

**Macintosh IIfx:** cc -mc68020 -mc68881 -elems881 -opt full -opt speed (MPW C 3.2)

**SPARCstation 2:** cc -O4 (Sun C)

**NeXT systems:** cc -O (Objective C 2.0, from GNU cc version 1.36)

*Some simple benchmarks; all times are in seconds, except for the Dhrystone2 benchmarks. For the Dhrystone2 benchmark, the higher the number, the faster the system; for all the others, the lower the number, the faster the system. Note that these benchmarks give only a general indication of CPU performance; they do not (and cannot) measure overall system response, because of the complexities of a multitasking environment. Each benchmark was run four times; the slowest time was thrown out, and the remaining three were averaged together.*

Here's a brief explanation of the benchmarks:

**Sieve** Sieve of Erastothenes algorithm to find all prime numbers less than 8192. The entire process is repeated *COUNT* number of times.

**Sort** Sorts a list of *COUNT* seven-character strings. The list is a numerical sequence in reverse order; uses a selection sort algorithm.

**Matrix** Multiplies two 50-by-50 integer matrices *COUNT* times.

**Float** Performs each basic floating-point operation (addition, subtraction, multiplication, division) 2**COUNT* times; subtracts the loop overhead time.

**Savage** Performs a set of floating-point functions (tan(), arctan(), exp(), ln(), sqrt(), multiplication) *COUNT* times.

**Circle** Draws alternating black and white circles with a radius of 200 pixels *COUNT* times (total of 2* *COUNT* circles). Note: the Macintosh IIfx benchmarks were run in 1-bit mode.

**Square** Draws alternating black and white squares of size 200 x 200 pixels *COUNT* times (total of 2* *COUNT* squares).

**Dhrystone2** A general-purpose integer benchmark developed by Reinhold P. Weicker (in West Germany) and Rick Richardson (in New Jersey), with contributions from others. The value for each platform is based on entering a value of 1,000,000 runs.



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Granted, much of that space is devoted to various tools and on-line documentation about how to use them, but that's still all part of UNIX.

## USER INTERFACE

The Macintosh proved that the concept of a graphical user interface (GUI) would succeed because of its ease of use. The interface itself is system-oriented, with a single, always-visible menu bar and a minimally changing Apple menu. The desktop metaphor, with folders, document icons, and a trash can, is combined with pull-down menus and cut-and-paste techniques to create an interface even novice users can pick up quickly. In fact, longtime Mac users are alternately amused and disgusted by all the hoopla over Microsoft Windows 3.0, which has managed to approach the point where the Mac user interface was half a decade ago. However, advancement of the Mac's GUI has stalled for the past few years, being improved primarily by third-party utilities. System 7.0 is the first major revision in quite some time and will introduce significant changes (and, we hope, improvements). All said, the Macintosh user interface still remains the most accessible and easiest to learn by computer novices, although in its current form it lacks some of the more modern UI features such as drag-and-drop of objects other than in the Finder, 3D look, and rich interapplication integration. As noted, some of these may be addressed in System 7, due out sometime this year.

Sun has been a bit slow in developing its GUI(s). Starting out with a classic UNIX command-line interface (CLI), Sun then went to SunWindows. This windowing system was a significant improvement on a single-screen CLI, but it came across as having been designed by engineers, not human interface specialists. Although the result had some nifty shortcuts, it was a bit crude compared to the Mac GUI. At one point, Sun was offering two GUIs: SunWindows and the PostScript-based NeWS (Network Windowing System); the latter was one of the first popular client-server window servers and was the first implementation of PostScript for a screen. Sun now also offers OpenLook 2, a GUI promoted by Unix International. OpenLook is designed by Sun in consultation with Xerox experts under license from Xerox. It is relatively clean and simple, focusing more on windows and pop-up menus and less on icons. It is heavily mouse-based: each window carries its own pop-up menus, mouse buttons (right, left, and middle) are significant, and there often are no key equivalents for menu actions. It also has extensive UI policy and support for drag-and-drop operations for tasks such as moving text or images from window to window. However, OpenLook doesn't do that good a job of hiding UNIX from the average user, nor it is as easy to learn and use as either the Mac or NeXT user interfaces.

The NeXT GUI, Workspace Manager, is actually one layer of the entire NextStep environment. Although it does derive some of its look and functionality from other efforts, it is still probably the most original and effective GUI released since the original Mac came out. The interface is application-oriented, with a floating menu visible for the current "front" application, though double-clicking files will automatically launch the requisite application in the background (if present). The File Viewer, with its file shelf and browser mode, eases much of the pain of dealing with a large, hierarchical file structure. Icons are used more heavily than in OpenLook, but they have more discipline in placement than on the Macintosh. In terms of complexity for new users, it falls between the Macintosh and OpenLook. Features that are rapidly migrating into other environments include the drag-and-drop mechanism, use of inspectors, a high level of interapplication integration through the Services architecture, and the effective use of gray, including its trademark beveled 3D look.

## BUNDLED SOFTWARE AND UTILITIES

The Macintosh comes with the least bundled software. It provides a few system utilities, such as a disk repair program, Font/DA Mover, and TeachText, and only one application: HyperCard. However, much of the functionality found in separate utilities in other systems—file locator, notepad, alarm clock—are preinstalled in the Macintosh user interface as "desk accessories."

The SPARCstation 2 comes with the usual suite of UNIX tools and utilities; a discussion of them could (and does) fill up an entire book. However, Sun has unbundled some system tools (such as compilers) that have traditionally been part of UNIX. Quite a number of programs and utilities specific to OpenWindows/OpenLook also come with the SPARCstation, including the file manager, a text editor, an icon editor, the print manager, a binder (for binding icons and other info to UNIX executables), a shell tool, a calendar, a clock, a preferences program, a previewer, the e-mail facility, and a number of demonstration programs.

The NeXT has the largest and most impressive suite of bundled utilities, applications, and documentation, not just of these three systems, but of any microcomputer or workstation. As with Sun, this includes most of the standard UNIX BSD 4.3 tools. But it also includes a full-blown development environment, a large assortment of useful and entertaining demonstration programs, a dozen or so genuine NeXTstep applications (such as WriteNow, Digital Librarian, and Digital Webster), and several NeXTstep-based system administration tools (NetManager, UserManager, MailManager, and so on). It also has the best suite of on-line documentation: extensive NeXT system administration documentation, a complete copy of the NeXT technical docs (for developers), system release notes, and special information for NeXT users—all highly formatted and saved as rich text format (RTF) documents. Important note: If you get a NeXTstation with a 105MB or 200MB hard drive, some of these files—such as the development tools and a lot of the on-line documentation—won't be installed, due to lack of disk space. However, you have a full license for all of them, and should you expand your disk storage, you can install the rest of the files from floppy disks.



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# Not an Artist?

# Not a Problem.

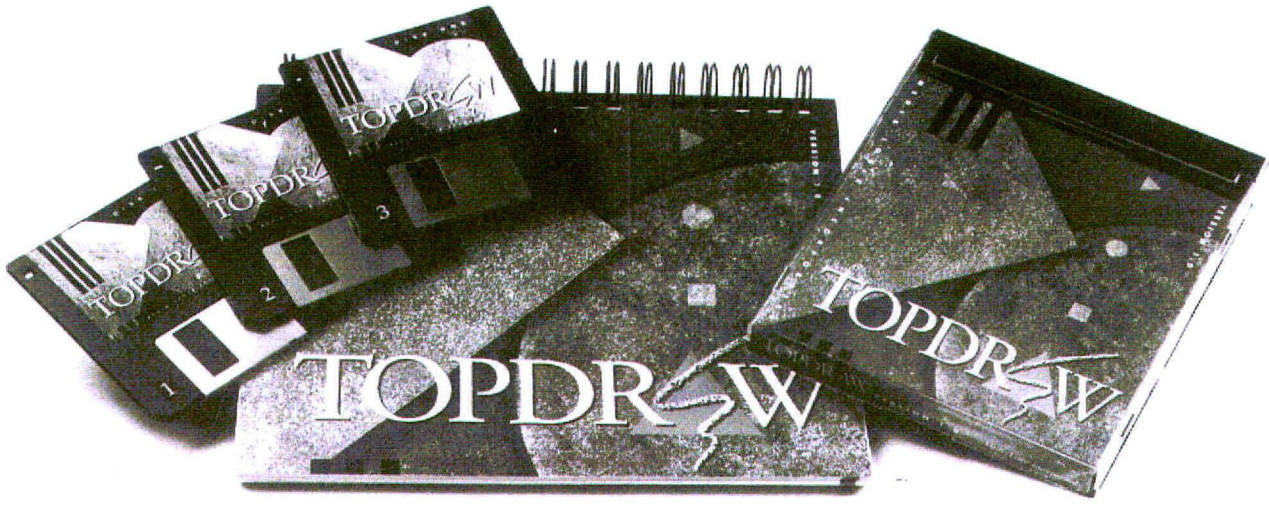


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*Table 3*

## Price comparison

| NeXTcube | | Macintosh IIfx | | SPARCstation 2 | |
|---|---|---|---|---|---|
| Basic unit | $9995 | Basic unit | $10,969 | Basic unit | $14,995 |
| 425MB hard drive | | 160MB hard drive | | 207MB hard drive | |
| 2.88MB floppy drive | | 1.4MB floppy drive | | 1.44MB floppy drive | |
| 16MB RAM | 400 | 8MB RAM | 200 | 16MB RAM | |
| MegaPixel Display | | Apple two-page display | 2149 | 19-inch monochrome display | |
| | | Macintosh display card 8·24 | 799 | Monochrome frame buffer | |
| Keyboard | | Apple keyboard | 129 | Keyboard | |
| Two-button mouse | | One-button mouse | | Three-button mouse | |
| Built-in Ethernet | | Mac II EtherTalk NB cable | 599 | Built-in Ethernet | |
| Release 2.0 (Extended) | | System 7.0 (when released) | | SunOS 4.0.1 w/Open Windows | |
| **Total** | **$10,395** | **Total** | **$14,845** | **Total** | **$14,995** |

*Pricing comparison of roughly equivalent systems. RAM upgrades (beyond manufacturer's minimum) is assumed to be at street prices of $50 per megabyte; all other prices are manufacturer's list price. Note that the NeXTcube has double the disk space of the SPARCstation 2 (and almost three times that of the Macintosh IIfx); this accommodates the full set of bundled utilities, applications, and development tools and still leaves more free space than the other two systems. Also, the Macintosh IIfx only requires 8MB to run well, even under System 7.0, while the NeXTcube and SPARCstation both really need the 16MB.*

**Other items to note:**

**·Putting A/UX 2.0 on the Macintosh IIfx will cost at least another $995.**

**·If you are running a Mac-only system, then you could drop the EtherTalk card and cut $599 off the Mac IIfx total.**

**·You can probably cut the price of the Mac IIfx system by at least $1000 by going with a third-party two-page display.**

### THIRD-PARTY SOFTWARE

The Macintosh wins hands down here for overall quantity, quality, and value. We're not sure how many Mac applications are on the market, but Apple claims over 10,000, and many of them are (at least) adequately done and decently priced. Moreover, the Mac market boasts first-class products in most application categories, often with several competing products to choose from.

Sun also has an active third-party market, claiming more than 2000 applications available for its SPARCstation line. This, however, includes a large number of non-GUI applications and utilities, and a large number of applications that use the old SunWindows GUI and don't interoperate well with OpenLook 2. Many of these applications are niche-scientific and technical applications that are as a rule quite expensive compared to typical personal computer software. Don't be surprised to find price tags of $1000 to $2500 for many applications that would cost under $700 on a Macintosh. Also, fewer than 100 of these applications actually make full use of the OpenLook environment.

NeXT, having the youngest system and the smallest installed base, has the lowest number of shipping third-party products—somewhere between 100 and 200 by the time you read this. However, the switch to floppy disks, the drop in prices, and the increasing installed base is drawing in a wider range of developers. More importantly, some of the applications shipping for NeXT are unequalled and unavailable on other platforms, such as Improv (from Lotus), TouchType (from Right Brain Software), and Diagram! (from Lighthouse Design).

### DEVELOPMENT TOOLS

Although the Macintosh IIfx has no bundled development tools (unless you want to count HyperCard), a wide range of environments and utilities are on the market. Apple continues to improve and promote the Macintosh Programmer's Workshop (MPW), a collection of compilers, debuggers, libraries, and other development-related tools that work together in an environment somewhat reminiscent of UNIX. Having decided that object-oriented programming is a good thing—after several years of ignoring the prodding of development tools product managers—Apple's management is finally giving more support to MPW's object-based products, such as MacApp, Object Pascal, Common Lisp (perhaps the best LISP implementation around), and MPW C++. Third-party tools, such as Think C, Think Pascal, Prograph, ExperLisp, and MacFORTH offer a solution suitable to just about every taste.

Sun, which used to bundle some of its compilers with SunOS, decided that it could cuts costs, reduce support, and (of course) make more money by selling them separately. Each language—C, C++, FORTRAN, Pascal, Modula-2, COBOL, and Common LISP—costs from $2000 to $4400 for media, docs, and a single right-to-use license. There are also lots and lots of third-party development tools for the Sun, including the best computer-aided software engineering (CASE) tools of the three systems, and the best-integrated development environments for large projects (Sabre, for example). All these third-party products, however, are really expensive, running anywhere from $2000 to $30,000.

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NeXT also offers an excellent development, but does so for free. NeXT bundles the Objective C compiler, a compatible C++ compiler, a source code debugger, and a number of NeXTstep development and debugging tools. The compilers and debugger are NeXT-extended versions of the Free Software Foundation tools; the compilers are widely recognized as being superior to Sun's and Apple's in terms of code generation. The NeXTstep tools include Interface Builder (an outstanding interface design tool that is oft imitated but yet to be equaled), AppInspector (for run-time browsing of object instances within an application), MallocDebug (to check for "memory leaks"), ProcessMonitor (for run-time inspection of various system attributes and resources of an application), and Bug56 (to debug 56001 routines). Each tool leaves some room for improvement, but collectively they form a powerful system for creating NeXTstep applications. The high level of integration between the tools and the machine OS environment—the coupling between Interface Builder, Objective C, Mach, and the user interface class library (the Application Kit)—is what makes the NeXT environment particularly productive. Third-party development of HyperCard-like products for the NeXT (rumored to be in the works) may help broaden the access of that environment to nonprogrammers as well.

## PERFORMANCE AND PRICING

Table 2 gives the results of some simple comparisons between an '030- and an '040-based NeXTcube, a Macintosh IIfx, and a Sun SPARCstation 2. Although these benchmarks don't take into consideration some of the complexities of comparing graphics-oriented multitasking systems, they do give an indication of relative performance. Your actual mileage, of course, may vary.

Table 3 gives configurations and pricing for some roughly equivalent systems from Apple, NeXT, and Sun.

## WRAPPING IT UP, TAKING IT HOME

As you can guess, each system has its own strengths and weaknesses. For the Sun SPARCstation, its strengths are its sheer power and speed, its UNIX compatibility, and the large assortment of tools and applications designed for scientific and engineering work. But it's still at its heart a UNIX box, and the user is constantly reminded of (and has to deal with) that.

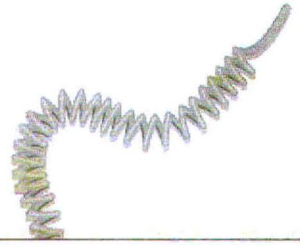
The Macintosh excels as no other computer in ease of learning and use, and in the number and variety of high-quality applications. It is also one of the easiest (if not the easiest) systems to set up, maintain, and administer. But the architecture, both hardware and software, has some inherent limitations, and Apple finds itself putting in more and more effort for ever-diminishing returns on system improvements.

The NeXT has neither the speed of the SPARCstation nor the software assortment of the Macintosh, nor, currently, does it easily merge into existing networks of Macs and PCs, though that scenario is changing rapidly. (See the department NeXTworking in this issue.) However, it bests the SPARCstation in terms of the quality of its user interface, ease of use, and integration of environment. At the same time, its system architecture has fewer obstacles and greater potential for future increases in growth and performance than the Macintosh. And a case can be made that the most interesting, significant, and useful applications being developed are being used on the NeXT system. Lotus Improv is a good example of this; it's the first real breakthrough in spreadsheets to come along in years.

All that considered, we'd have to say that the NeXT is the best deal of the three systems, and not just because this article is appearing in *NeXTWORLD*. The combination of performance, utility, and price is impressive, and unless you have a major roadblock in terms of data compatibility and networking, you'll find the NeXT worth looking at. Most important, if you are starting from ground zero, with few if any other systems already in place, the NeXT could be an ideal choice.

**Edward Jung** *is the program manager for the Information at Your Fingertips Project at Microsoft Corporation and a principal of the Deep Thought Group L.P., a neural network research and development group.*

**Bruce F. Webster** *is author of* The NeXT Book *(Addison-Wesley, 1989) and vice president of research and development at Pages, a software company in San Diego, California.*





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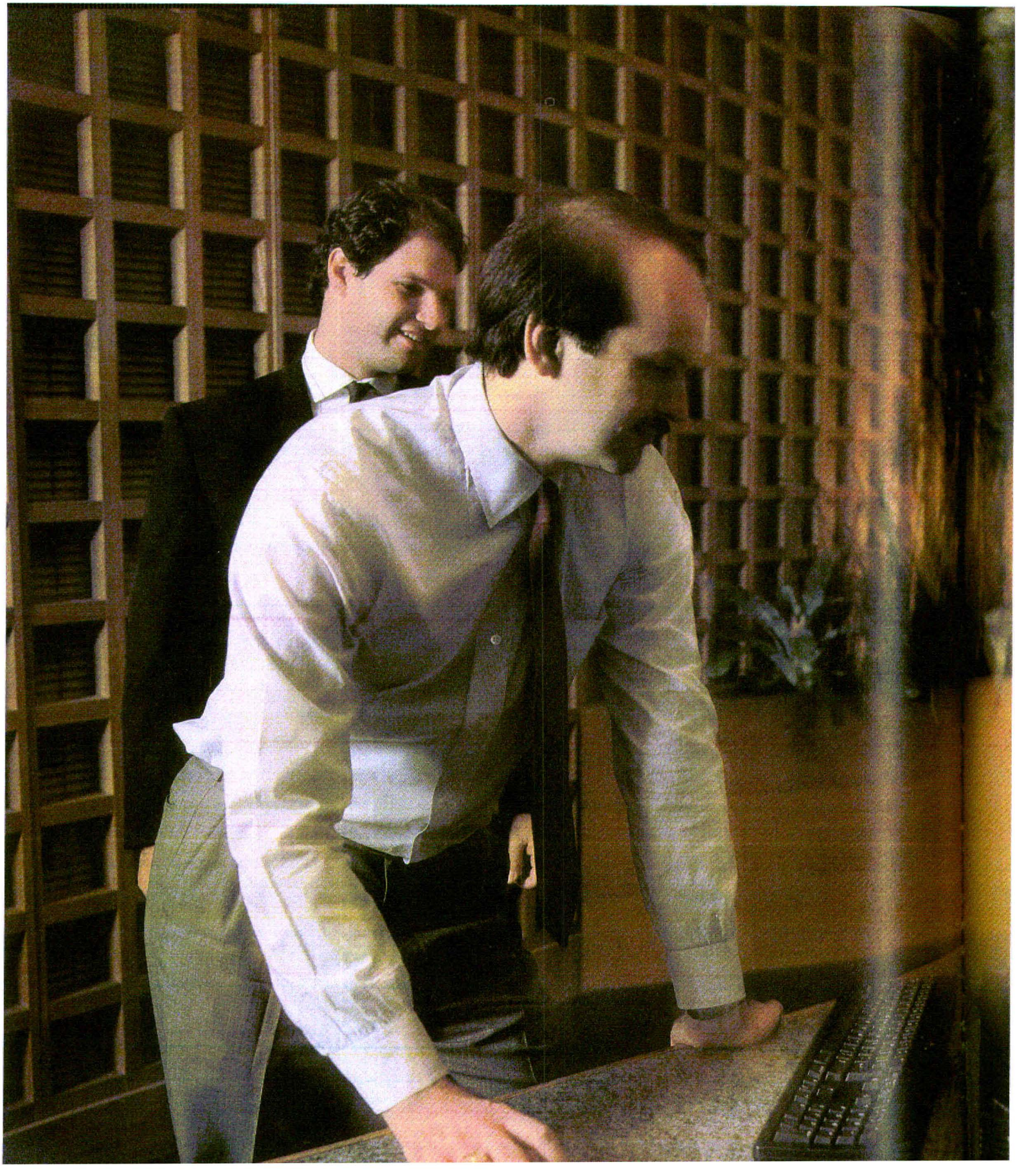

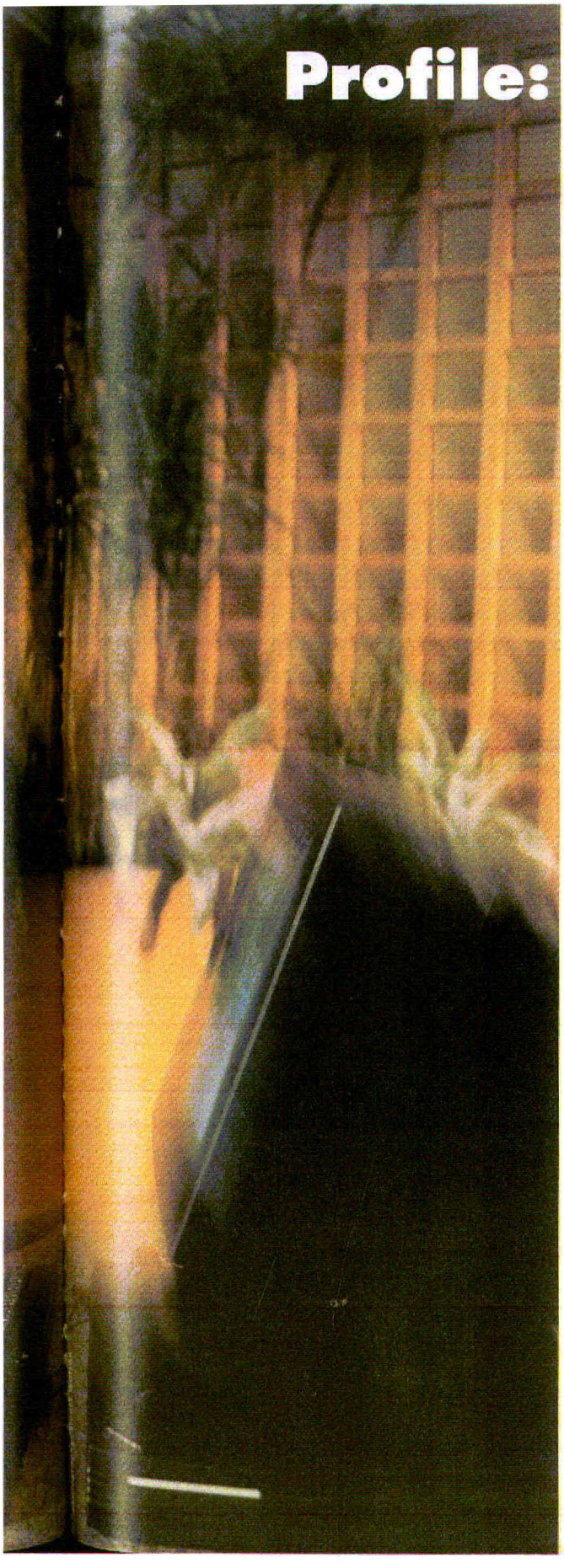

# Profile: The Star System

**Customized client-contact software and e-mail help Beverly Hills' William Morris Agency keep track of its stars.**

by Karen Balch

"The nature of the talent agency business is information," says Chris Godsick, one of more than 100 agents at the Beverly Hills, California, headquarters of the William Morris Agency. "That's what gives one agency the competitive edge over another; it's who has the information and who's able to disseminate it effectively to the agents."

William Morris is the oldest and one of the largest talent brokers in the world. The agency represents some of the biggest names in the entertainment world, including actors, directors, producers, musicians, lecturers, and others. Having information available on demand—such as an actor's availability, credits, booking data, or financial history—can make or break an important deal.

"Situations are always coming up at a moment's notice, and you have to be ready to react," Godsick says. "During pilot season, deals need to be closed whether it's Saturday night at 11 o'clock or Sunday morning. Basically, whatever you need to do for the good of the client, you do."

Most of an agent's business is conducted over the telephone: He or she makes and receives between 40 and 200 calls per day. There's no time for telephone tag or missed messages.

"Every time I have to call somebody back because I don't have answers to their questions initially, I'm wasting time," says Godsick. "But if I can answer their questions on the phone, my clients are happy, my buyers are happy, and I'm happy. The relationship is better because clients are being serviced promptly."

**Automating communication.** A year ago, a walk down the long, narrow hallways at William Morris provided a glimpse of the bustle of talent agents—juggling phone calls, dictating memos to assistants, and dashing from office to office as they closed million-dollar deals. The scene was characterized by loads of paper, lines at the Xerox machines, and reps searching for documents among myriad files in steel filing cabinets.

Things are a little different now. The offices—filled with worn leather chairs and solid wooden desks that characteristically depict the longevity and

*Agent Chris Godsick and director of MIS Alex Henry in the William Morris conference room.*



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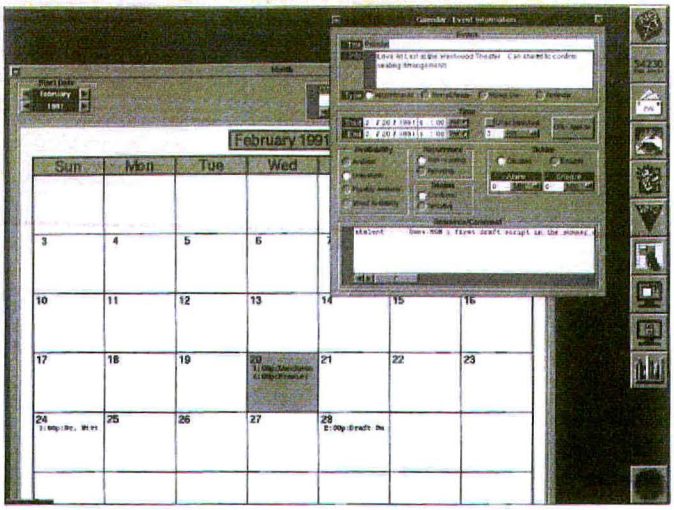


*The calendar module of William Morris's customized Who's Calling? application includes a month view that can be expanded to show details of a client's schedule.*

tradition behind this esteemed 92-year-old company—include something new: NeXT computers.

"Accounting has been automated for years," notes Alex Henry, director of MIS. "The Personal Appearance Department has three Novell networks—one per office—so they've got automation. Beyond that, there were only a few scattered PCs."

About three years ago, the agency started looking for a computer system that would support its varied needs. The main objective was to increase the efficiency with which its agents share information—among departments and across geographic and time zone lines, to the firm's offices in New York, Nashville, London, Rome, Sydney, and Munich. The goal was to reduce the time spent gathering and dispensing information. This would allow agents and their assistants more time to devote to each client, thus enhancing the company's services by improving agent-to-client interaction. Because its communication needs were specialized, the agency also needed a platform that could support quick and cost-effective development of customized software.

To help choose a system, the agency hired the accounting firm of Deloitte & Touche. As the consulting team studied the agency's needs, four criteria emerged: an easy-to-use graphical interface; multitasking capabilities; high-speed, worldwide networking; and stringent levels of data security. After a long assessment, William Morris decided it needed a full-scale executive support system that included every agent and assistant in the company.

"Extending the Novell networks was one option," explains Henry. "Taking the IBM System 38s and putting terminals on them was another. We also talked about Macs." They settled on networked NeXTs. "We ended up with NeXT computers in large part because they're easy to use," Henry continues. "They're easy to learn, fairly easy to program, and they have the interpersonal communications capabilities that we need built into them."

Senior Vice President Mike Simpson, who co-heads the agency's West Coast motion picture department, helped spearhead the push for the NeXT platform. "There was really only one possibility, and that was to go with a graphical user interface," he says.

"Most everyone was computer phobic," Simpson explains. "Many of our agents didn't even know how to type, and they were proud of the fact that they didn't use a computer—that they could carry all the information around in their heads, or that they'd write it on the back of a matchbook." Convincing the established agents that they could actually benefit from the computerization of this traditional office, Simpson says, could have been a difficult task with a less intuitive interface than the NeXT's.

**Tailor-made software.** The agency initially ordered 250 NeXT machines for its Beverly Hills and New York offices and foresees the possibility of buying more. To date, approximately 200 are installed and connected between the two cities, with the bulk in Beverly Hills. Most of the machines are NeXTcubes using 40MB swap drives. NeXTstations started arriving in January



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and will make up nearly one-third of the original order. To ensure security, the agency opted not to have optical disk drives (removable media).

BusinessLand (NeXT's distributor) and NeXT introduced William Morris to Adamation, a NeXT developer in Oakland, California, to answer the agency's need for customized client-contact software. Adamation is addressing this need with a special version of its commercially available Who's Calling? client-management program. "Since we could develop software [by customizing packaged versions] much faster on the NeXT than on any other platform," says Adamation's president Stephan Adams, "we were able to bring it to them much more quickly. Two of the reasons for that are the NeXT's Interface Builder and the applications that NeXT offers."

Who's Calling? includes a database for client information; programs for monitoring and tracking telephone calls and meetings; a calendar system for scheduling of multiple events; a tickler function that implements voice response in order to automatically remind users of scheduled events; a report generator for reports, form letters, mailing labels, and other information-sharing functions; and a message center for communicating text or voice messages.

The customized version includes a Rolodex-type directory; a phone memo sheet on which agents can quickly record calls in a client's database record; a library module for keeping track of videocassettes, scripts, and other materials on loan; and a complex calendaring module.

The directory feature lists common numbers used by every agent, while other fields are reserved for private numbers. "For example," Simpson explains, "the president of Warner Brothers will be in everybody's directory, but my dentist is only going to be in mine."

The phone sheet provides a form for quickly entering notes from phone calls into a client's record. "When somebody calls, you type in the first three or four letters of their last name, hit return, and the computer will look in the database and pop in their full name and phone number," Simpson says. "At some point, it will also be able to recognize the call coming in and pull up the data automatically." Agents can quickly dial a client's number by clicking on the phone number in the form.

The calendar module is divided into three sections—individual, group, and world—to allow scheduling of individuals or groups of various sizes. "Let's say you want to set up a meeting with five different agents here in the department," Simpson suggests. "The old way was that my secretary would have to call each of them. Just as she'd get four of them lined up, the fifth couldn't do it and she'd have to call them all back again. This way, you can call up their calendars, and—because they're graphically rendered—you can lay them one on top of the other and it shows you what the open time is."

Agents also use the scheduling feature to track the availability of clients. "Often you've got an actor—say, Tom Hanks—who's doing a movie in March, and then he's doing another one in August, and then he may be available in January. We have those time periods blacked out where he's definitely not available, it's gray where he might be available, and it's clear where he's definitely available."

When an agent makes a booking, he or she will record it in another module of the software, entering data such as the client's name, the buyer's name, the type of contract, the terms of compensation, and the shooting schedule. The compensation information will automatically be posted to the client's financial history so that agents can later run queries and sorts if desired. After a film that an agent has booked is actually shot, the program posts the information about the deal to a report that lists each client's produced credits.

"If I'm on the phone with a business affairs executive at Warner Brothers trying to get $2 million for a client, for example, and the exec's saying that they've never paid a director with two credits going into his third movie $2 million, I can pull up a list of all our director deals at Warner Brothers with three or less credits for $2 million or more and be able to say, 'Wait a minute. Two years ago, you gave so and so two and a quarter, so don't tell me that.'"

**Internal affairs.** The specialized software modules are currently being tested and should be fully implemented by April. In the meantime, agents are taking advantage of standard Who's Calling? features and the NeXT system's networking, multitasking, and e-mail capabilities, which allow them to quickly access and share timely data. That they can exchange critical information instantly—long before staff meetings occur—has caused a marked shift to a more strategic use of valuable time.

"It's totally changed the way we do business," says Simpson. "The e-mail alone has done that. In the past, when you'd get information, if it was really important, you'd call somebody and play telephone tag for a while until you finally got through to them. Otherwise, information that was important but not crucial would eventually be disseminated, but maybe up to a week later—and then it may have been too old to use. Now, everything that happens goes out instantly on e-mail."

The e-mail system that NeXT provides with its computers includes not only text but voice and picture features as well (see the review in this issue). "Today, some people here use voice [in e-mail]," Henry says. "There's limited use of still picture. We're not using moving picture at this point, but we've seen prototypes."

Simpson is excited by the changes the NeXT has already wrought in William Morris's service. "The e-mail, as critical as it is right now, is only the tip of the iceberg," Simpson promises. "I think you can sense from all this that we're definitely among the converted."

**Karen Balch** *is a free-lance writer living in Orange County, California.*



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You're witnessing quite an important moment in the history of the Motorola 68040 microprocessor.

It's actually shipping. In volume.

And while advances in chip technology have become an almost annual event in the industry, you may rest assured that

# MOTOROLA DELIVERS THE REVOLUTIONARY 68040.

there's never been anything like the 040 in a desktop computer before.

With its "single chip implementation," the 040 is as much an economic breakthrough as it is a technological one. Because many of the sophisticated functions that used to require expensive additional equipment are now built in.

For example, the 040 chip incorporates the capabilities of a "floating-point" coprocessor. So it can not only handle high-level mathematical routines, but do so up to ten times faster than its powerful predecessor, the 030—the processor at the heart of many of today's fastest machines.

Cache memory has also been built in, to further speed the chip's operations.

While we're on the subject of speed, we're pleased to report that the 040 chip delivers a full 15 MIPS. In overall performance, that's 300% better than the 030. (And, for comparison, literally twice the performance of a Compaq Deskpro 486®.)

Of course, the 040 chip was designed to be perfectly compatible with all those computers that have been built around other chips in the 68000 family. So it will support the enormous base of 68000 software that currently runs on Macintosh® and UNIX® platforms.

The 040 is the result of an extraordinary effort by Motorola engineers. But if you think the chip is something, wait till you see what happens when you build a computer around it.

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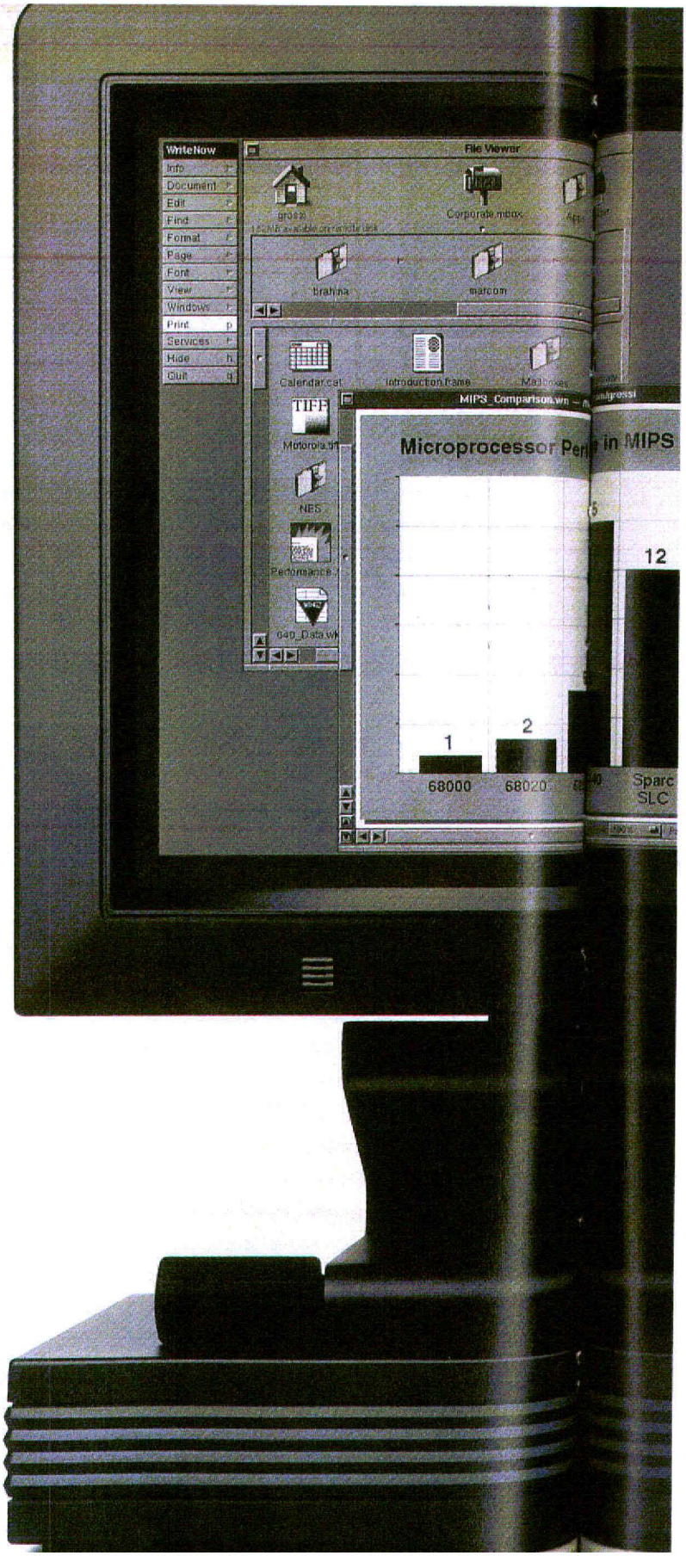


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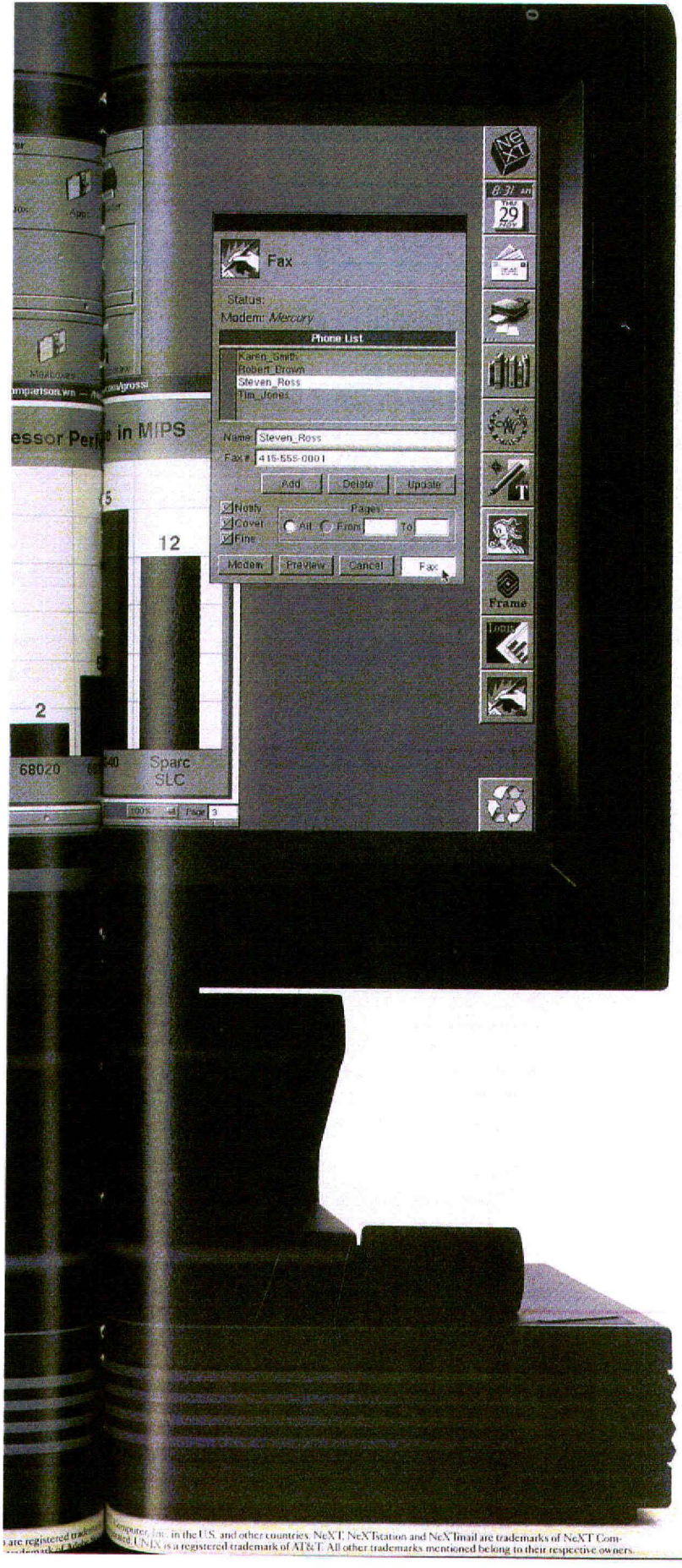


By no coincidence, this is also a milestone in the history of NeXT™ computers. As promised, the NeXTstation™ computer is now officially shipping. In volume.

It's the first computer designed to take advantage of Motorola's most recent feat of engineering: the 68040 processor.

# NeXT DELIVERS THE FIRST COMPUTER THAT HAS IT.

The NeXTstation offers the networking and multitasking power of UNIX, but without the complexity most workstations are known for. The graphical NeXTstep® environment makes it as easy to use as any desktop PC. Even Macintosh.

But the applications you can run on the NeXTstation are beyond anything you've seen on a desktop computer before.

Lotus® has recently unveiled Improv,™ a revolutionary spreadsheet that lets you view your data in infinitely different ways. WordPerfect® is offering the first "What-You-See-Is-What-You-Get" version of its best-selling word processing software. And Adobe® will soon be releasing the NeXT version of Illustrator,™ which fully exploits NeXT's pure PostScript® environment.

And with true multitasking, all of your applications can run at once. Including NeXTmail™—provided with every NeXT machine—which helps keep you in contact with everyone in your working world, using text, graphics and voice.

The NeXTstation computer comes complete with the 17" MegaPixel Display, 8 megabytes of memory, a 2.88MB floppy drive, a 105MB hard disk and both thin- and twisted-pair Ethernet. All for $4,995. Reason enough for *Byte Magazine* to say the NeXTstation "may now be the workstation price/performance leader."

If you'd like a brochure describing the NeXTstation computer in detail, just call 1-800-848-NeXT. We deliver.

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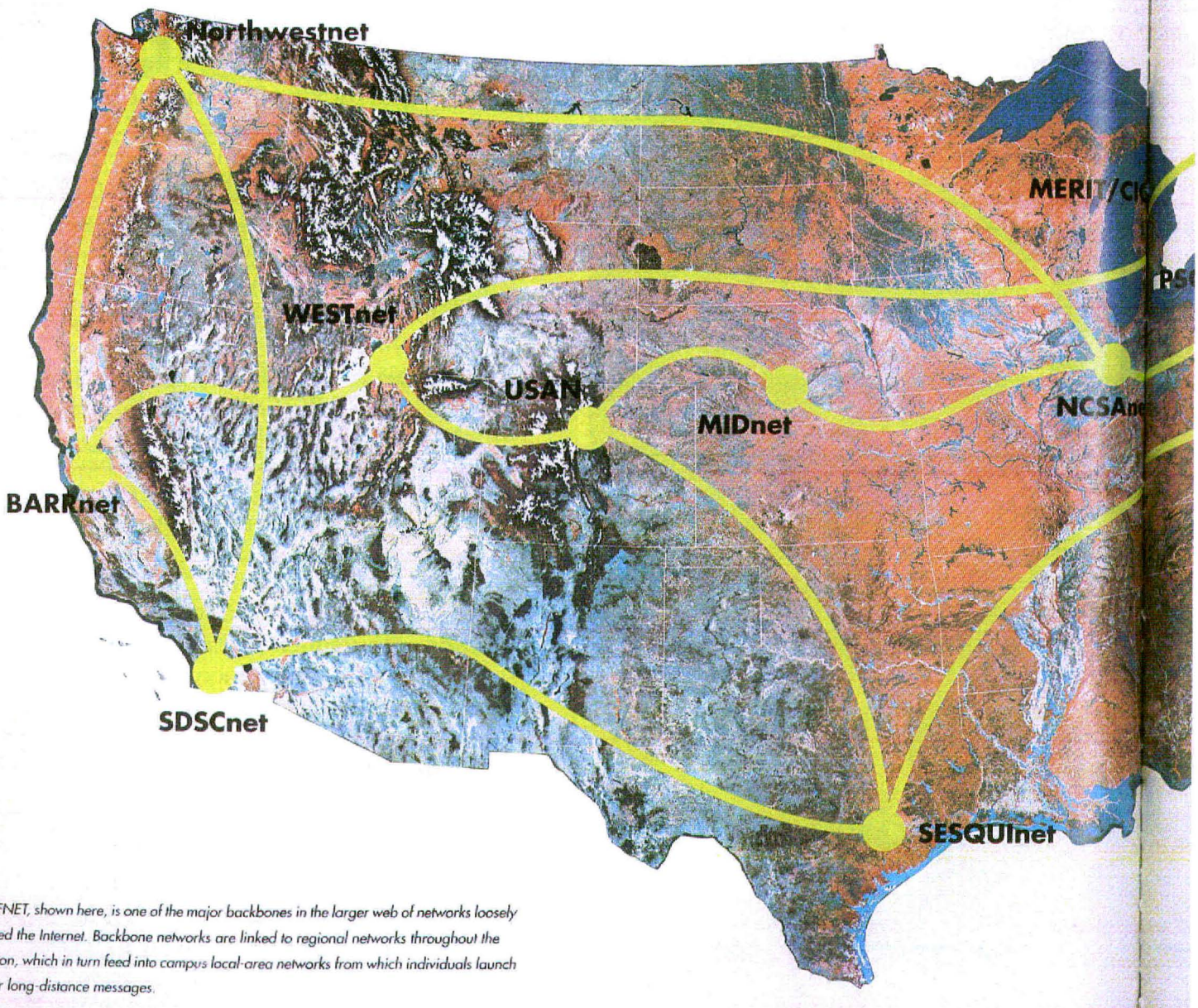


*NSFNET, shown here, is one of the major backbones in the larger web of networks loosely called the Internet. Backbone networks are linked to regional networks throughout the nation, which in turn feed into campus local-area networks from which individuals launch their long-distance messages.*

Source: *The User's Directory of Computer Networks*, edited by Tracy L. LaQuey (Digital Press, 1990). Maps used here were supplied by Charlie Catlett, National Center for Supercomputing Applications (NCSA), University of Illinois, Ubana-Champaign, June 1989.



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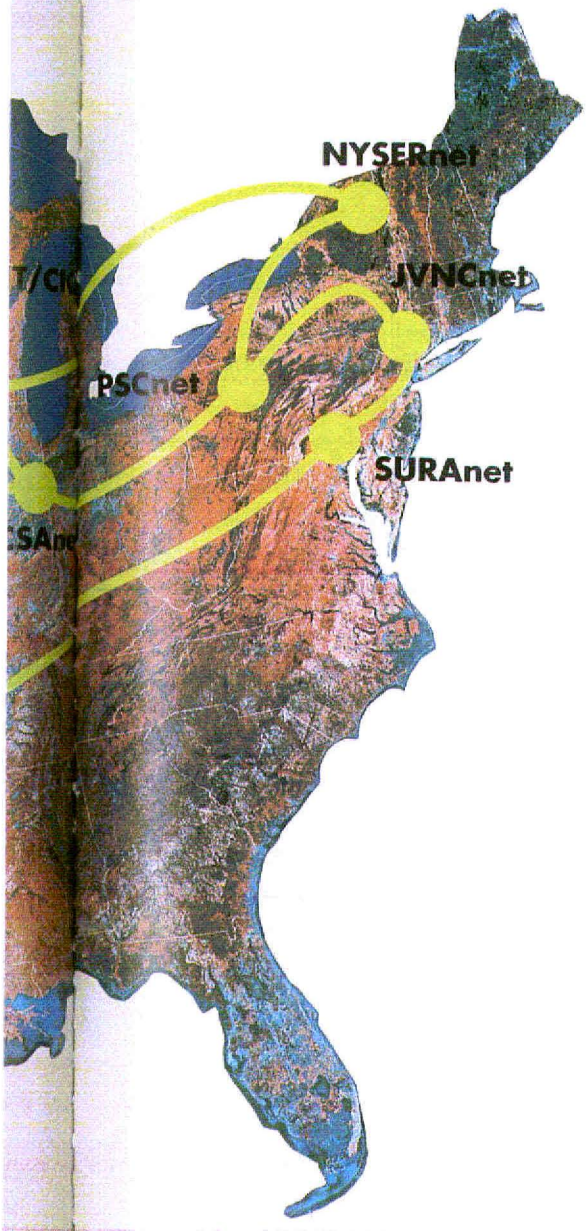
# Quick and to the Point




**The Internet links UNIX desktops for high-speed transmissions to any part of the globe.**

by Paul Baer

Scientists announce discoveries, such as the recent advances in high-temperature superconductors, and they are discussed around the world within a matter of hours. A chemist performing AIDS research views images of molecules on her computer screen in San Francisco that she generated remotely on a supercomputer in San Diego. Programmers working on a development project quickly and easily move entire programs back and forth across the country to share them with collaborators.

These are but a few uses of the Internet, the international high-speed computer network that connects scholars and researchers across the globe. As more computers are connected every day, this network is rapidly becoming as indispensable a method of communication as the telephone and is changing the ways in which all types of research are conducted.

"A researcher with a new idea can post it on the Internet and immediately get feedback from the best scholars in the discipline, no matter where they are located around the world," says Geoff Goodfellow, president of Anterior Technology, a network-services provider in Menlo Park, California, and a member of the Internet community since 1973. "We are no longer subject to the delays of publishing in journals or the expenses of traveling to conferences."

**The backbone's connected to the...** The Internet is hard to define precisely. Generally, it can be explained as the various interconnected computer networks in the U.S. and abroad that support TCP/IP (Transmission Control Protocol/Internet Protocol) for computer communications. Because TCP/IP provides a communication standard, any computer on a LAN (local-area network) that is connected to the Internet can interact with any similarly connected machine elsewhere on the network in what is effectively real time.

The Internet has a hierarchical structure. At the highest level are several national or international wide-area networks, often called "backbones." One such backbone in the U.S. is NSFNET (the National Science Foundation Network), which connects universities, private and government laboratories, and commercial research organizations. The backbones connect to smaller mid-level or regional networks, which are usually, but not always, based on geo-



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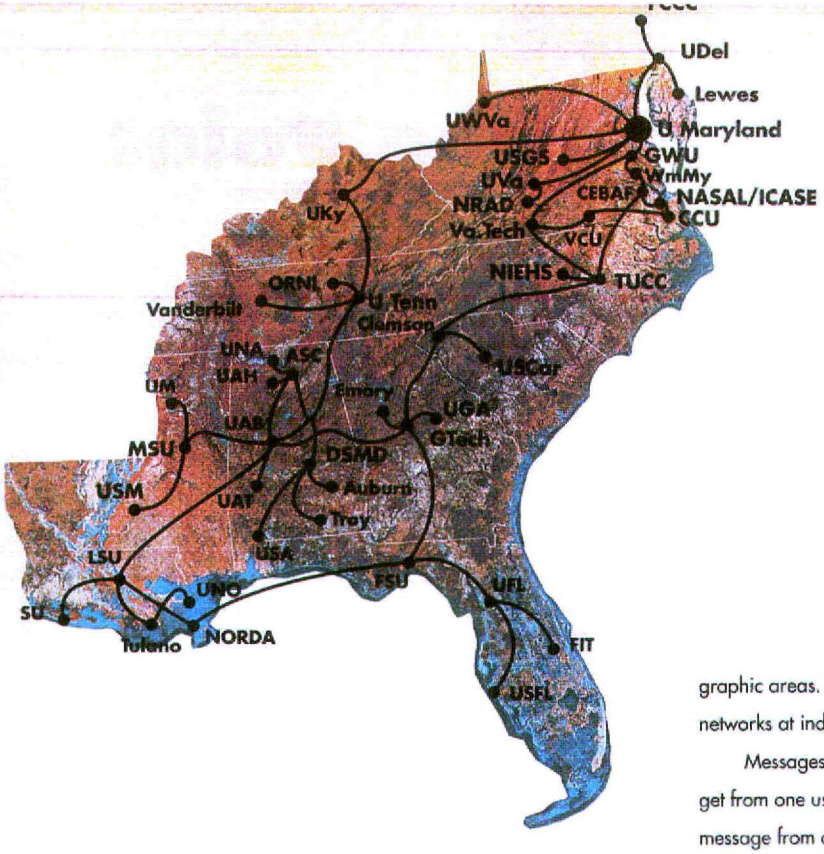


*The Southeastern Universities Research Association Network (SURAnet) connects universities in the Southeastern United States. SURAnet began operation with ten universities and two "stub" sites in 1987. It now has 64 sites on line. SURAnet is linked to the NSFNET backbone at the University of Maryland.*

graphic areas. The regional networks, in turn, connect the various "campus" networks at individual sites; these are usually complex LANs.

Messages must pass up and down through this hierarchy of networks to get from one user to another. Consider, for instance, the path of an e-mail message from a geology professor at the University of Chicago to a researcher at an oil exploration company in Dallas. The message would first pass from the university network, up through a regional network in the Midwest, and on to a backbone. Then it would come back down through a regional network in Texas to the corporate LAN at the exploration firm.

**Deep roots.** The Internet evolved from early computer networks developed in the late '60s and early '70s, particularly the ARPANET, operated by the Defense Department's Defense Advanced Research Projects Agency. TCP/IP was developed for use on the ARPANET, which was originally an experimental network created for research into packet-switching. As the capabilities of the ARPANET developed, and as other networks, such as CSNET (a nonmilitary network for computer science), were created and connected to existing networks, scholars and researchers became increasingly dependent on this electronic community for the basic conduct and communication of their work.

In the mid-'80s, a federally funded National Supercomputing Initiative channeled resources into establishing a national computer network and a group of regional supercomputing centers around the country. This effort eventually grew into what is now the NSFNET. At the same time, other countries were developing their own research networks. Gradually, all of these networks were linked together, forming a sort of web of networks reaching into Eastern and Western Europe, Australia, and Japan. In 1989 the ARPANET was phased out.



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Today, nearly every major university in the U.S., many foreign schools, most of the scientific branches of the U.S. government, and an ever-increasing number of commercial organizations engaged in research and development (particularly of computer hardware and software) are connected to the Internet. As the benefits of the Internet are becoming more widely recognized and the technology more standardized and less expensive, smaller schools (even some high schools), laboratories, and other organizations are joining. The total number of organizations currently exceeds 2000 and is growing rapidly.

**What sets it apart.** The Internet is most commonly used to transfer e-mail and large files. But unlike other networks, which provide e-mail and file transfer on a "store and forward" basis, the Internet also provides users with the ability to log on to computers at distant sites, enabling access to remote computers.

At the University of California at San Francisco, for instance, researchers use the Internet to access supercomputers in San Diego for biochemical research into AIDS and other diseases. "We need to use supercomputers because the computation required for modeling complex biomolecules, which may involve tens or hundreds of thousands of atoms, exceeds the capacity of most workstations," explains Thomas Ferrin, a professor in the Pharmaceutical Chemistry Department at UCSF. Ferrin also notes that the Internet facilitates communication with commercial research companies, such as DuPont, which may be located thousands of miles away from the research site.

Remote access to NSF supercomputers is awarded through a grant process similar to the one used for regular NSF grants, available to recipients of National Science Foundation grants in lieu of a portion of their funds. Other users can make individual arrangements with—and payments to—owners of private supercomputers for access to their machines. "Without the Internet," Ferrin says, "the cost of [buying] supercomputers would put them beyond the reach of most institutions."

Another factor that distinguishes the Internet from other networks is the high speed and capacity at which it moves data. Most of the backbone circuits operate at a speed of 1.5Mbps (bits per second), and several 45Mbps links were scheduled to be installed in late 1990 and early 1991. Just three or four years ago, the fastest links on the Internet were typically 56Kbps. This increase in speed and capacity makes it a practical way to move very large files—be they computer programs, graphic images, or simply long text documents—that previously would have been sent on tapes, disks, or paper, if they were sent at all.

To gain a little perspective on these numbers, it is helpful to make a few comparisons. Typical office LANs, for instance, operate at speeds from 230Kbps (for LocalTalk) to 10Mbps (for Ethernet). A page of text may be 25,000 to 30,000 bits in size; a single graphic image may be 10 million bits or more; a large computer program may easily be 100 million bits. When it ran at just 56Kbps, the Internet was slower than the slowest office LAN and could move perhaps two pages of text in a second; a graphic image could take several minutes. At 45Mbps, the Internet is faster than most office LANs and can move 1500 pages of text in a second and a large graphic image in a fraction of a second.

Because the Internet can move huge files so quickly, numerous archives of documents and programs can be usefully maintained on it. These archives, which are located and administered at different sites around the Internet worldwide, include technical papers on the Internet itself, public-domain software for a wide variety of computers, and ongoing discussions on diverse subjects. (See The NeXT World, in each issue of *NeXTWORLD*, for information on the comp.sys.next newsgroup on the Internet.) Internet users do not need accounts or passwords on the host machines to access the archives. This arrangement is inviting to users and limits the administrative burden.

**Who's running the show?** The control and administration of the Internet reflects the decentralized way in which it has evolved. At the highest level, the Federal Research Internet Coordinating Committee (FRICC) brings together representatives of various federal agencies involved in the Internet. The Internet Activities Board is responsible for overall design and planning. The board ensures coherent technological development by working through groups like the Internet Engineering Task Force and the Internet Research Task Force.

Backbones have their own administrative bodies and technical workgroups that are responsible for developing infrastructures. The mid-level and regional networks coordinate their activities through a body known as FARNET, the Federation of American Research Networks.

Much of the administration of the Internet is handled by the Network Information Center, operated for the federal government by SRI International (a private, nonprofit research organization in Menlo Park, California) and usually referred to as the NIC. In earlier days, the NIC registered every computer and user on the Internet. Now it coordinates the registration of new networks (currently more than 3000 are registered), maintains directories of hosts and users, and houses the primary archives for documents related to the development of the Internet.

To link up to the Internet, universities and other institutions must join a mid-level or regional network such as BARRNet (the Bay Area Regional Research Network) in Northern California, or SURAnet (the Southeastern Universities Research Association Network). Representatives of the participating institutions collectively administer the circuits and equipment, determine fees and membership requirements, and plan the evolution of the network. Individuals typically cannot join the Internet; they must belong to an organization that is connected.



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## Further Readings

For more information about the Internet, check out these titles at your local bookstore or library.

### Books


Comer, Douglas E. *Internetworking with TCP/IP: Principles, Protocols and Architecture.* Englewood Cliffs, N.J.: Prentice Hall, 1988.

Frey, Donnalyn, and Adams, Rick. *!%@:: A Directory of Electronic Mail Addressing and Networks.* Sebastopol, Calif.: O'Reilly & Associates, May 1990.

LaQuey, Tracy Lynn. *Users' Directory of Computer Networks.* Austin: Office of Telecommunication Services, University of Texas System and Digital Press, 1990.

O'Reilly, Tim, and Todino, Grace. *Managing UUCP and Usenet.* Sebastopol, Calif.: O'Reilly & Associates, December 1989.

Quarterman, John S. *The Matrix: Computer Networks and Conferencing Systems Worldwide.* Bedford, Mass.: Digital Press, 1990.

Todino, Grace, and Dougherty, Dale. *Using UUCP and Usenet.* Sebastopol, Calif.: O'Reilly & Associates, July 1990.


### Periodicals


*NSF Network News.* Published quarterly by the NSF Network Service Center (NNSC), located at BBN Systems and Technologies, 10 Moulton St., Cambridge, Mass. 01238.

*The Link Letter.* Published monthly by the Merit Computer Network/NSFNet, 1075 Beal Ave., Ann Arbor, Mich. 48109–2112.


### Additional Sources


Krol, Ed. "The Hitchhikers Guide to the Internet." RFC118, Menlo Park, Calif.: Network Working Group, SRI Network Information Center, September 1989.

Socolofsky, T., and Kale, C. "A TCP/IP Tutorial." RFC1180, Menlo Park, Calif.: Network Working Group, SRI Network Information Center, January 1990.


A more extensive bibliography is available from the SRI Network Information Center at 333 Ravenswood Ave., Menlo Park, Calif. 94025. Ask for RFC1175, "Where to Start—A Bibliography of Internetworking Information."


Adamation can help you hold down tons of information...

...with Who's Calling?, the most advanced client data management system available today. For the first time, you can rein in all your complex client information easily. Who's Calling? is designed to work as easily over a network as on a single computer, and it's available exclusively on NeXT.

Who's Calling? consists of four interacting modules. There's a Calendar for project management of one or many people, with features such as "voice-annotated ticklers" to keep schedules on track; a Client Database with customizable fields and a media well for attaching voice, text, and images to client records; a Conversation Manager that logs the history of all phone conversations and automatically posts call-back dates and times to the Calendar with voice-annotated ticklers; and a Message Board, a multimedia supplement to NeXT Mail for broadcasting live



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As a method of communication, the Internet parallels the American telephone system, both in the way it is structured and in the way it is used. However, there is one major difference between the two in terms of administration: There are no direct usage charges associated with the Internet, no equivalents of long-distance tolls.

Institutions pay membership fees to support the regional and mid-level networks and must also pay for their own site networks. The backbones are typically paid for by the government (the NSFNET alone currently costs about $15 million annually, with additional funding from the Department of Defense, the Department of Energy, NASA, and several state governments). There is no charge to the user, though, to send an e-mail message or transfer a file. This is a result of several factors, among them the sheer administrative difficulty of charging individuals by usage, and the desire of both government and individual institutions to encourage people to use this new and relatively unfamiliar technology.

**Down the pike.** A powerful motivation that fuels further development of the Internet is an understanding in the U.S. that we need to boost scientific education and research if we hope to remain competitive in the global marketplace.

One discussion currently taking place in the networking community and the federal government concerns developing a National Research and Education Network (or NREN). The name refers to not only the proposed physical network but also the organizational structure that would administer it and the legislation that would fund it. Although the legislation authorizing funding for further research and development of NREN stalled in the last Congress, plans are still in the works to establish this national network that would attain a capacity of 3Gbps (3000Mbps) or more by the end of the century. That capacity is more than 60 times greater than the fastest existing U.S. backbone and powerful enough to transfer the contents of the *Encyclopedia Britannica* in one second, making possible applications such as real-time videoconferencing, distributed computing, and others not yet imagined.

Because the field of computer networking is evolving so rapidly, it is impossible to say precisely how the Internet will develop technologically and administratively. But the notion of the Internet, one network transparent to all users, will remain with us in the same way that a single telephone system has come to be taken for granted. It is probably safe to say that the changes the Internet will make in our lives will eventually be as profound as those of the telephone. Φ

**Paul Baer** *is assistant director of BARRNet, the Bay Area Regional Research Network at Stanford University.*

Note: You can keep up with the current happenings and discussions on and about the Internet in The NeXT World column in this and every issue of *NeXTWORLD*.

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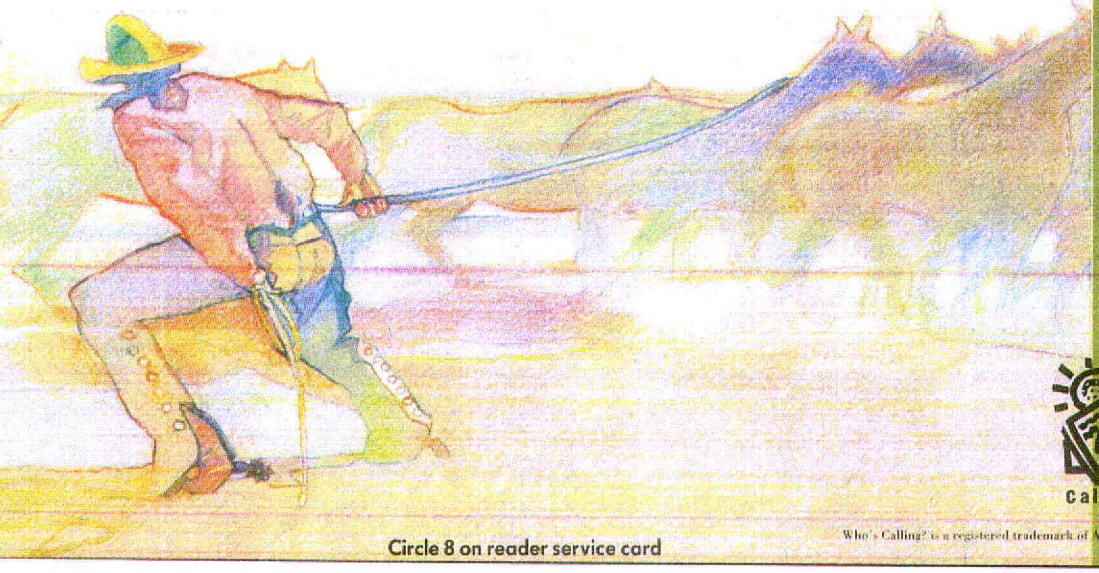
Call us. We're forging ahead on the NeXT frontier, and we'd like to take you along.



Who's Calling?

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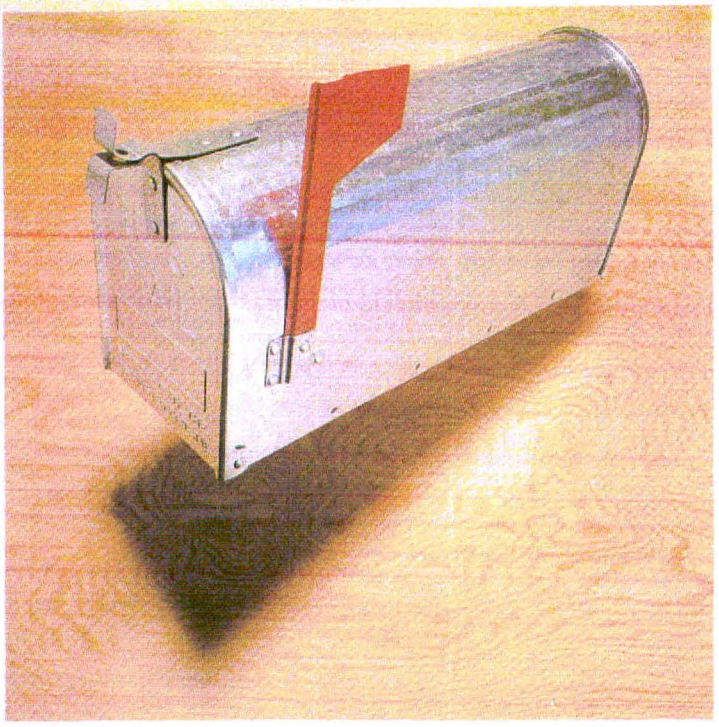

# Pushing the Envelope

**NeXT's bundled e-mail application provides the tools for effortless multimedia communication.**

by Robert D. Nielsen

CONNECTIVITY

**NeXTmail 2.0**

The NeXTmail system, bundled with every NeXT machine, takes advantage of the machines' DSP to add a new layer—voice annotation—to current e-mail standards. Although some features are less than intuitive, the system works effectively to make multimedia communication almost effortless.

Free with NeXTstep 2.0

*NeXT Computer, 900 Chesapeake Drive, Redwood City, CA 94063. 800/848-NEXT*

Steve Jobs calls e-mail the "substrate" of interpersonal computing (IPC), not its definition. That said, though, there is no denying that NeXTmail, the e-mail software provided with every copy of NeXTstep, provides a model for NeXT's vision of IPC. An application specifically designed to help members of a networked workgroup work effectively together, NeXTmail takes advantage of the platform's key technologies: UNIX, the digital signal processor, and interapplication communication are all bound into important NeXTmail features. The result is a stunning example of how rich communication through a computer can be.

Personal computer e-mail software has come a long way since the days when only the bravest PC users would tackle the command-line interface, dip switches, and protocol setups necessary to run the personal modem. The friendly iconic interface of Apple Computer's AppleLink software, combined with its ability to attach binary (formatted) files, provided the first communication software for the rest of us, thereby freeing e-mail from its connotations of telegraphic text streams in cyberspace. Macintosh e-mail systems for AppleTalk networks have carried on the tradition.

The connection of workstations for workgroup computing and the Internet have made e-mail links to colleagues an intrinsic part of network communication systems. But UNIX systems have historically placed little emphasis on ease of use. NeXTmail brings the ease of use commonly associated with Macintosh communications programs to UNIX. With NeXTmail, NeXT has made a strong statement about the kinds of communication they think coworkers need, and what interpersonal computing consists of.

**Mixed media.** Implementing the capability to send formatted documents with e-mail messages was an important step in elevating e-mail from a medium for telegraphic messages to a mode of transferring work for collaboration. Taking advantage of the digital sound processor (DSP) built into every NeXT computer, NeXTmail upped the ante with sound. With NeXTmail, users can enclose in their memos spoken messages, music, or any other aural information. Enclosed TIFF and EPS graphics images are automatically displayed. This means that NeXTdimension owners could theoretically send video productions back and forth with the same method, though the large files may severely tax the bandwidth. All types of documents can be enclosed in a single message, creating a mini multimedia presentation for the recipient. Co-workers



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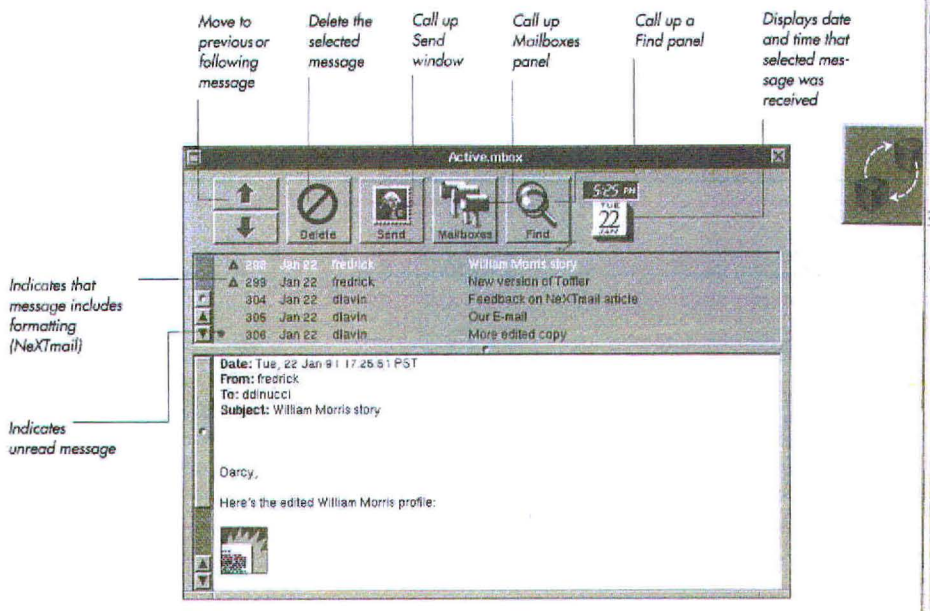
across the nation can collaborate on a proposal, complete with formats and necessary illustrations. Voice annotation might call the recipient's attention to an important point in the document and explain points not included in the text. (At NeXT Computer's offices, the system is configured to automatically add a scanned-in photo of the sender for an additional interpersonal touch.) The goal is to allow the sender to express himself or herself effortlessly and eloquently, by any useful means.

Unfortunately, this vision can take place only in the world of NeXT machines. Formatted information can only be exchanged between machines that run the same or compatible software, and non-NeXT computers cannot read documents or graphics created with NeXT-specific software, let alone decode Lip Service messages. Messages can still be sent to those less fortunate users of other platforms, but the text must be constrained to the standards of the recipient's machine. (A button in the Send window strips NeXT-specific information from messages so they can go to linked users on other computers.) But even when you discount NeXTmail's multimedia capabilities, it still represents progress. It embodies the philosophy of the NeXTstep user interface, characterized by point-and-drag and intuitive interaction with files and other on-screen objects.

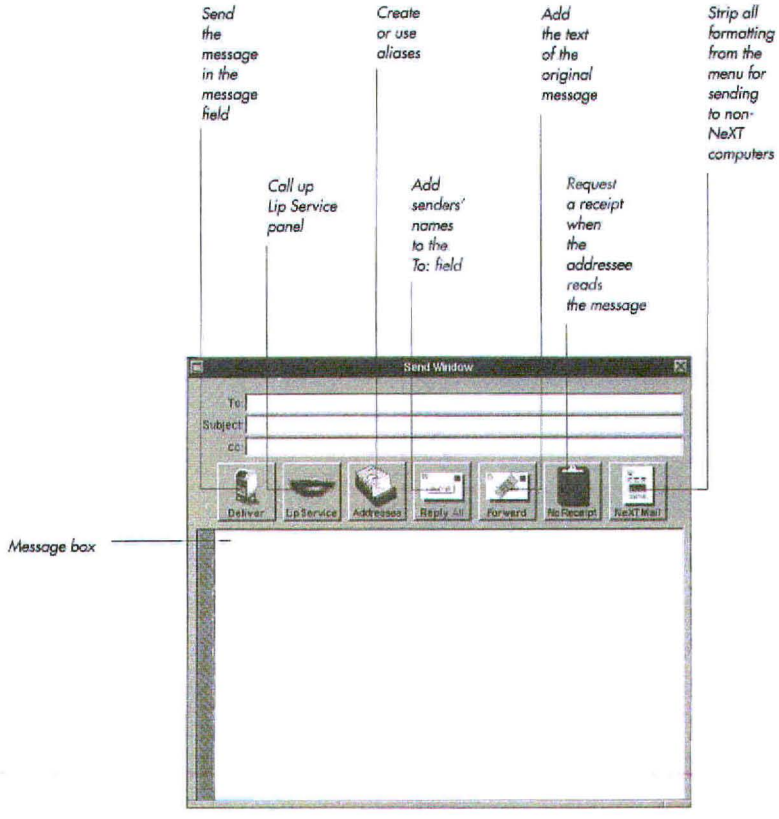
Because NeXTmail is based on UNIX, it can also give access (with the proper subscription, a modem, and a phone line) to the Internet or the UNIX-to-UNIX Copy (UUCP) network. (For more on these services, see the article "Quick and to the Point" and The NeXT World in this issue.) These networks hook you up with a world of UNIX users and information. Connections to just about any NeXTmail service, anywhere, including MCI, CompuServe, and others, are available through the Internet.

**Any way you say it.** NeXTmail's main window is the "active mailbox," one of any number of mailboxes you can create. The active mailbox serves as a holding cell for any new NeXTmail received. Messages are listed at the top, along with each message's subject and the name of the person who sent it. Selecting a message displays its contents in the text window. Buttons at the top of the mailbox allow you to move to other functions and files.

To send a message, you click the Send button in the mailbox, bringing up a separate Send window. To:, Subject:, and cc: fields identify the mes-




*The active mailbox is NeXTmail's main window. Here, you can view and store messages you've received or move to the Send window.*




*The message box in NeXTmail's Send window can include information of any kind: formatted text, displayed graphics, Lip Service recordings, or documents. Clicking Deliver sends the message on its way. Other buttons choose options of varying degrees of usefulness (see the other illustrations for more on some of them).*



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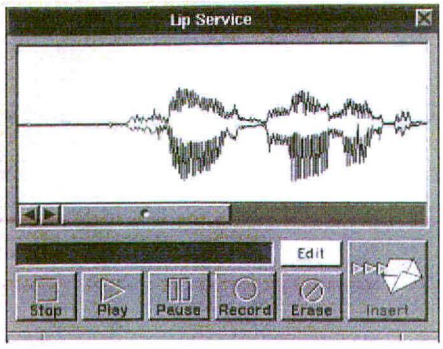
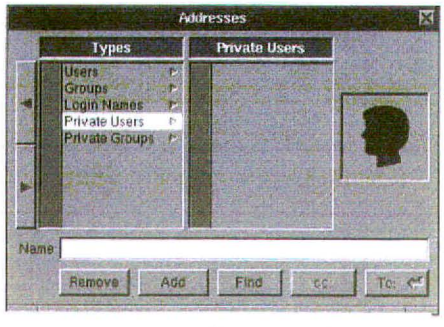



*NeXTmail's Lip Service panel uses the familiar metaphor of a tape recorder. The long gray field acts as a sound level display. Clicking Edit calls up a panel (shown here) in which the message is displayed as a waveform, which you can select, erase, and copy sections of to alter the recorded sound.*




*You can create or remove aliases (group addresses or shorter user names) with the Addresses panel, available from the Send window or from the Tools menu. To add an alias to the To: field in the Send box, you choose the name, then click To:.*

sage. A text box below provides a place to construct it, and a new set of buttons supply addressing and delivery options, plus access to Lip Service.

NeXTmail incorporates the text-editing features of the new Application Kit's Text object, including a spelling checker and a find utility. As in any standard NeXT application, Command-b adds or subtracts boldface in selected text and Command-i supplies italics. NeXTmail uses NeXTstep's standard Font panel and Page Layout panel. The Font menu provides the standard options for bold, italic, superscript, subscript, and larger and smaller size, plus unusual options for graying text and copying fonts. You can insert a very simple ruler with Command-r, allowing you to set tabs and margins. Unfortunately, the only tab option available is for left-aligned tabs; there are no options for decimal or centered tabs.

Attaching files from other applications in a message entails simply dragging the file's icon from NeXTstep's File Viewer into the mailbox window. The file is then represented in the message by its icon (annoyingly minus the document's name), which can be moved and deleted just like any text character. TIFF and EPS files are an exception to this rule. As mentioned earlier, they are immediately displayed on screen—great for adding your personal signature (previously scanned in one of these formats) to documents that you send. The message's recipient can simply double-click the icon of the attached document in the mailbox window, and the document's application will be immediately launched (if present) and the document will be displayed.

The inclusion of graphics or documents is an important feature of NeXTmail, but their different treatment creates some user interface confusion: TIFF and EPS files are expanded and shown directly in the window (whether you want them to be or not), but all others (even RTF files, which one might very reasonably want to have expanded into the mailbox window) are displayed by icon and are attached. The user should be able to configure or override these behaviors.

**Lip service.** One noteworthy medium in NeXTmail is Lip Service, the voice annotation feature. This voice recorder/editor/player has a perfectly intuitive interface, using the cassette recorder we all know well as its metaphor. Record, Stop, and Play buttons work just as you would expect. You speak into the microphone (optional equipment on the first NeXT computers, but built into the new monochrome MegaPixel Display and into the Sound Box that comes with NeXT's MegaPixel Color Display). Clicking Edit brings up a window with an editable waveform. Max Headroom's trademark vocal style is no longer a mystery to anyone who has spent a few minutes playing with Lip Service. We had a lot of fun copying a section of a voice and pasting it several time-time-times.

The completed recording is represented by a pair of lips in the NeXTmail window. When the recipient double-clicks the lips, a Play panel appears. Clicking Play begins the playback.

**Sending and receiving.** After you've added an addressee's name and a subject notation, clicking the Deliver button in NeXTmail's Send window dispatches the completed message. Other buttons let you request a list of addresses or notification when the recipient has read your message. The button that strips NeXT-specific information from the document for sending to non-NeXT computers is also located here.

Clicking Addresses calls up a panel that lets you choose or create aliases for people you communicate with frequently. (The panel is also available through NeXTmail's Tools menu.) Creating aliases lets you use short, memorable names for people whose e-mail addresses are complex and hard to remember. For example, Eric Scott's e-mail address is eps@toaster.sfsu.edu. I've created an alias for him, Eric_Scott. Even better, aliases can refer to groups: I may have an alias called "Red_Team," which refers to everyone in my work group. To insert an alias in the To: field of the Send window, you select it in this panel and click To:.

The Addresses panel is one of the rougher implementations in the application. Aliases are maintained internally in five categories: Users, Groups, NeXTmail Names, Private Users, and Private Groups. The operating system's slip is showing here. Because NeXTmail has been implemented on top of UNIX, you need a system administrator to set up and maintain the aliases—a serious problem for enterprisewide networks. Also, NeXTmail should be able to directly access the NetInfo database for users and aliases.

Another odd decision of NeXT's was to hide the Blind cc: and blind Reply To: fields in a panel that is available only through the Tools command in the NeXTmail menu—and then to call the command Options. These fields should be part of the main mail window.



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An optional archiving feature (activated by clicking Archive in the Preferences panel) causes NeXTmail to keep copies of any message that you send—a useful way to document and track your daily work flow. The only other way to archive outgoing messages electronically is to add your own user name to the cc: field or group alias for every message you send.

**Disposing of NeXTmail.** Once you've read an incoming message, you may choose to delete it, forward it on, or archive it. (I prefer to archive any message with content, even if the content is only the return address.) NeXTmail provides options for each. Sadly, these features are not very well thought out.

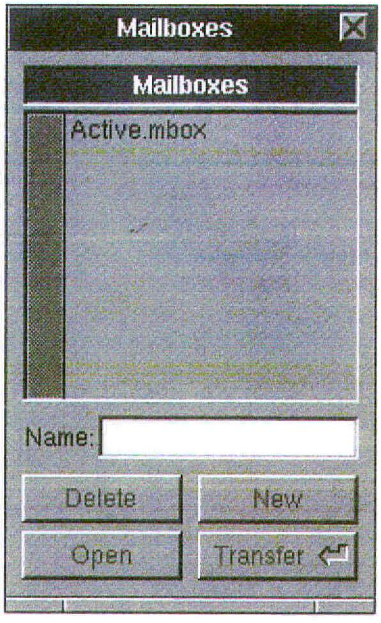
To reply to a message in your active mailbox window, you first click Send (in the mailbox window), and then the Reply button in the Send window. The action simply fills in the To: and Subject: fields with the address of the sender of the original message and the subject of the first message, preceded by "Re:" For some reason, though, the text of the first message—necessary for reference—is omitted. A far more useful interface would be to have the Reply button in the mailbox window, automatically calling up the Send window with completed fields. Clicking Forward in the Send window copies in the original text.

To save messages, you first have to make a special mailbox for yourself, using the mailboxes panel (available in the active mailbox window or from the Tools menu). You can create any number of mailboxes, with any name you choose, and each mailbox can store an unlimited number of messages. The idea of using another mailbox as a storage place, unfortunately, is hardly intuitive. Even aside from the confusion inherent in the nomenclature, the idea has its problems. If NeXTmail allowed me to save my messages in the directory of my choice, then I could take better advantage of my archived messages by using Digital Librarian to build indexes for me. As it stands, each mailbox is stored by as one huge file. To find a message, you open the mailbox where each message is listed in the order it was archived. The interface is identical to the active mailbox, with the same buttons and options. You can sort the messages in any mailbox using commands in the Utilities menu.

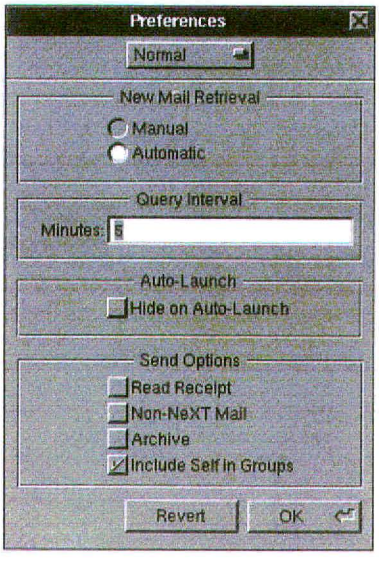
The presence of a Compact utility points out another flaw in the system. Deleting a message with the Delete button in the mailbox does not actually delete it; the system saves it so that you can "undelete" it later. The messages are not truly gone until you use the Compact utility. This presents not only a security problem, but a space problem as well. Users' mailboxes could soon hold many megabytes of messages.

**So close.** It's a pity that these interface flaws mar the shine of the NeXT's showpiece application. These glitches, however, can't hide the fact that, as a system, it does its job admirably—and adds whole new media to our concept of workgroup communication. Its presence in a connected UNIX workgroup system (networked NeXTs) is an undeniable encouragement to workgroup communication. On the NeXT's multitasking system, users can have NeXTmail always launched, so that a message can be on its way in a matter of seconds. Cutting text or graphics out of one document and pasting it into a mailbox window adds perhaps five seconds to the process. Voice annotation may add ten (depending on the length of the message, of course). It all adds up to a level of effortless communication not seen before and serves as a model for the future of interpersonal computing.

**Robert D. Nielsen** *is an independent software consultant and registered NeXT developer.*




*The Mailboxes panel, available from any mailbox or from the Tools menu, is where you create, delete, and open mailboxes or transfer messages to secondary mailboxes for storage—a rather odd concept.*




*NeXTmail's Preferences panel allows you to request send options, such as read receipts and text-only formatting (non-NeXT NeXTmail) for every message. You can also request to archive every message you send and to include your own address in every group alias you create. You can also control how and how often NeXTmail queries the server for new messages. An expert level of Preferences controls settings, such as where NeXTmail looks for and stores messages.*



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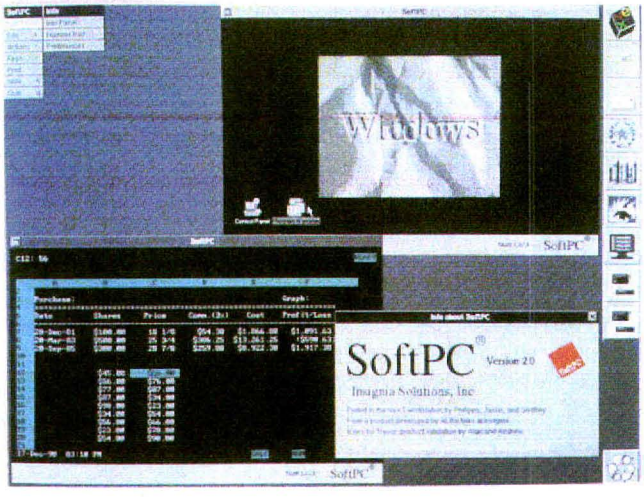


# DOS on the Dock

by Robert D. Nielsen

PC users get understandably enthusiastic when they first see a NeXT machine. The benefits of multitasking, interpersonal computing, and NeXTstep are immediately apparent. Two obstacles, though, obstruct their path from a PC to a NeXT. First of all, something as momentous as a platform change requires transition time. Second, certain specialized DOS programs may never be ported to the NeXT. And even though those programs may represent only a small part of someone's work, that small part may be critical.

SoftPC solves these problems by enabling NeXT computers to run DOS programs. This undertaking is so important and so difficult, and SoftPC succeeds so well at it, that SoftPC ranks as one of the most important programs for the NeXT.

We ran several popular PC programs under SoftPC—including Lotus 1-2-3 Release 3.1, dBASE IV, Wordperfect 5.1, and Microsoft Windows 3.0—without any trouble. In fact, we have used SoftPC in several different settings, and we have never seen any problems at all. There is little to say—it simply works. And even though we do not rate the speed of beta products, we can say that, even in beta, SoftPC delivers the promised performance of a fast AT or slow '386—blazingly fast for an emulator.

**Software hardware.** Amazingly enough, SoftPC accomplishes its task entirely in software. The two 1.44MB disks (one program, one documentation) contain all you need to make your machine DOS-capable. It will work on any machine running NeXTstep 2.0. A 68040 processor is recommended, but this is not a problem because the vast majority of machines will already have one.

SoftPC emulates an IBM PC/AT with an Intel 80286 processor and an 80287 math coprocessor. Your program's 80286 instructions are executed by an extremely fast interpreter (the heart of SoftPC), which converts them to code that will run on the NeXT computer's native Motorola 68030 or 68040 processor. From the NeXT's point of view, SoftPC is just another program. But once it is running, SoftPC creates an artificial environment for your MS-DOS applications that makes them think that they are actually running on an IBM PC.

SoftPC supports graphics up to full EGA (you can set a preference for either CGA or EGA monitor emulation). In either mode, you can set SoftPC to emulate either 4 or 16 gray levels on a monochrome NeXT monitor. Color NeXT monitors should display color PC programs in color, but because we didn't have access to a NeXTstation Color or NeXTdimension, we couldn't test the color display.

The graphics emulation means that Windows 3.0 runs just fine under SoftPC. (A nice touch: Your NeXT mouse emulates a Microsoft mouse when it is in the SoftPC window.) The program also emulates expanded memory (conforming to the 4.0 LIM specification), allowing your DOS programs up to 32MB of RAM.

SoftPC gives your PC programs full access to the keyboard, mouse, printer, and even serial devices, such as modems. You can also configure SoftPC so that your NeXT computer's SCSI devices (such as a CD-ROM drive or scanner) are available, though this configuration requires a user to be exceptionally knowledgeable about the NeXT computer. Favorite DOS activities such as printing the screen are also supported.

**File sharing.** In at least one important way, SoftPC improves on the native capabilities of the IBM PC architecture: SoftPC has its own file-



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sharing architecture (FSA). This is exceptionally useful because the directory structure of FSA disks is shared with your UNIX file system; that is, each FSA disk is made into a UNIX directory, and each file on the disk is also visible as a UNIX file. This means that you can move files from the IBM PC world into the NeXT world by simply copying them from IBM PC floppies or non-FSA virtual hard disks into an FSA disk—after that, the files are visible under UNIX. Similarly, you can move UNIX files into an FSA directory, and they will appear the next time you execute DOS's DIR command.

FSA makes the process of converting your IBM PC files to the UNIX world so easy that you can rely on making the conversion regularly. Imagine that you still run your company's database system using dBase under SoftPC, but you have switched over the publishing of your weekly company newsletter to FrameMaker running in the NeXT environment and you need to transfer a report from the database program into your page-layout program every week. With SoftPC, you can configure your DOS database program to save the report in text form into an FSA directory, and then import it into the NeXT application each week before you print the newsletter.

FSA also breaks DOS's normal 32MB hard disk limit. Even without using FSA, however, you may have as many 32MB hard disks on your simulated PC as you like; you are limited only by the hard disk space of your NeXT computer. Each PC hard disk simply looks like a very large file from the NeXT's point of view. In fact, you can even make backups of entire PC hard disks by simply copying the hard disk file into a different directory or to a different hard drive or optical drive on the NeXT.

**Disk, disk.** It's a pity that SoftPC can't use 2.88MB floppy disks, the standard floppy disk size of the NeXT computer system. This limitation arises mainly out of the PC's file architecture. The program also falls short in the way it deals with external floppy disk drives. If you have an external floppy drive (probably connected to the SCSI bus), formatting disks under SoftPC is impossible. Luckily, the NeXT's BuildDOS program can format disks on these drives, but who wants to leave the program for such tasks? Also, external disk drives cannot be used for PC programs that use master-disk copy protection schemes. Many older PC applications, such as earlier versions of Lotus 1-2-3, made heavy use of such schemes, so this limitation could prove troublesome to some users.

Ergonomically, SoftPC could use some improvement. Its display, which is light gray on black, can be difficult to read. The light-gray color is a bit too dark to make a pleasing contrast with the black background. Insignia should have included a user preference that allows users to invert the PC screen for a better effect.

Emulation of the PC keyboard's extended keys (such as function keys 1 through 12) are supported through the use of a NeXT menu; to hit the PC's F2 key, you select F2 from SoftPC's Keys menu. Although this arrangement works well enough, it is a shame that there is no graphical representation of the PC keyboard and keypad.

SoftPC supports two communication ports (COM1 and COM2) and two printer ports (LPT1 and LPT2). This arrangement is consistent with the needs of most DOS programs, but experienced PC users will note that the real IBM PC/AT can have four communication ports, whereas SoftPC can have only two.

Despite such minor flaws, SoftPC is a great program. It aimed high and made the mark. Not only will its sales help Insignia, but its presence helps the NeXT platform overcome a major hurdle: migration from DOS. We gave SoftPC four cubes, the highest possible for a beta, but it's a good candidate for five when we update this review.

**Robert D. Nielsen** *is an independent software consultant and registered NeXT developer.*

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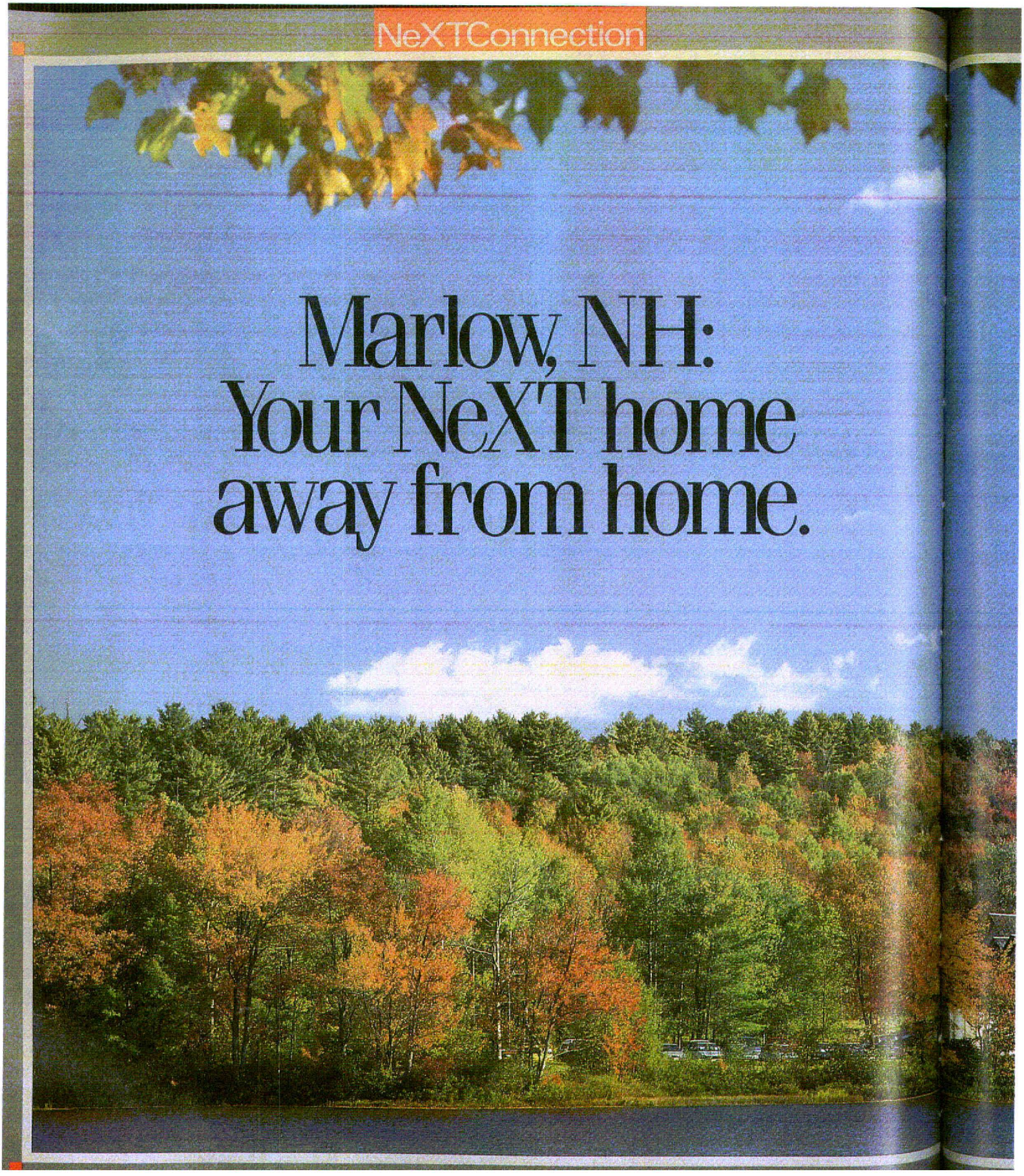


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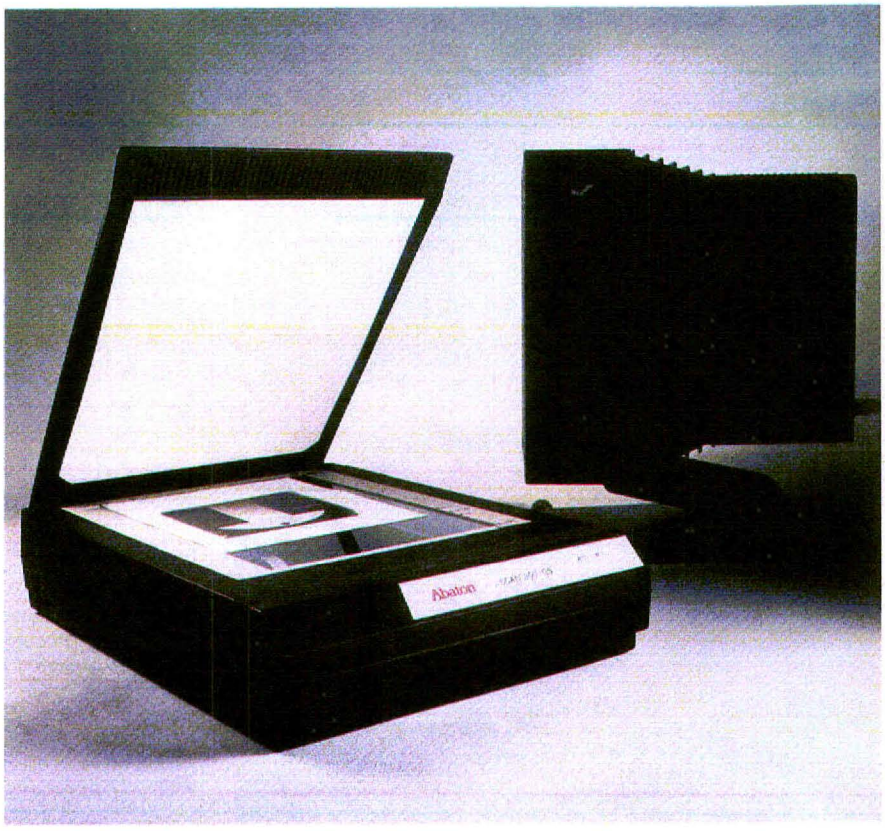


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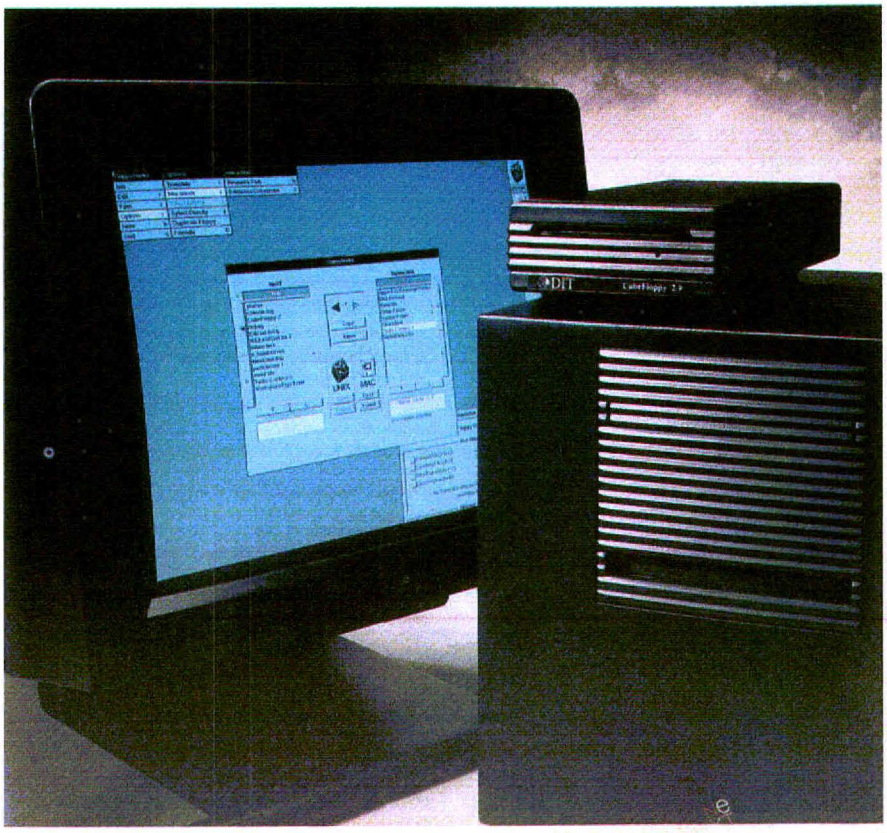


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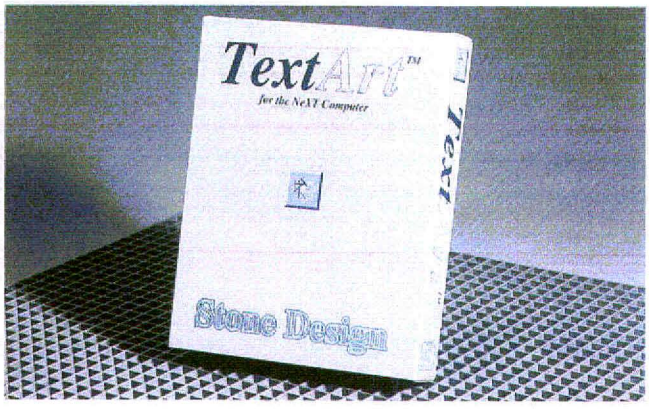


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# GatorBox

by **Rick Reynolds**

The GatorBox—an intelligent gateway in a platinum-tinted, free-standing box—links NeXT or other TCP/IP networks to AppleTalk or EtherTalk networks. AppleTalk, serial, and thick and thin Ethernet ports on the GatorBox (no twisted-pair as yet) provide the means for the physical connection, and a Motorola 68000 processor (running at 10MHz) and 1MB of dynamic RAM provide the capacity for monitoring traffic on the network, routing, and translating information packets, as necessary.

The basic package ($2795) includes the GatorBox itself plus GatorKeeper, software that provides the basic connection and a command-line interface for using simple UNIX commands to control the NeXT. Additional software, available in separate modules, allows the user to share printers and send e-mail to non-NeXT computers on the network, and provides a more intuitive interface.

GatorPrint ($595) translates the NeXT's "lpr" print commands (the standard for UNIX-based computers) into the LaserWriter's "pap" form, allowing NeXT users to control Linotronic and other imagesetters as well as LaserWriters on the network.

GatorShare software ($1995) is what makes the GatorBox truly useful. GatorShare connects AppleShare to UNIX's NFS file-sharing scheme, so that when a user on a connected Macintosh selects a NeXT server with the Macintosh's Chooser desk accessory, the directories appear as folders in the Macintosh directory window. To move files to and from the NeXT server, the user treats them like any Macintosh file, dragging them in and out of folders. Unfortunately, GatorShare does not support the reverse function; the user cannot mount a Macintosh folder as a directory in the NeXT workspace. All file manipulations must take place from the Macintosh.

GatorMail software ($995 for ten Macintosh users) routes e-mail between NeXTmail (or any other UNIX mail system using SMTP, the Simple Mail Transfer Protocol) to Macintosh packages such as CE-Software's QuickMail or Microsoft Mail.

The cost of GatorShare ($1995), added to the cost of the GatorBox ($2795), makes for a very expensive system. You could do the same thing for much less money, but it would take a lot more trouble. For instance, you could share files between NeXT and Macintosh computers by simply putting a modem on each computer and calling the NeXT from the Macintosh for a remote login, but dragging folders is much easier.

This is not to say that the GatorBox is trouble-free. The biggest drawback to the GatorBox is the arduous initial set-up process. Screen after screen of mystifying numbers and obscure settings quickly become overwhelming, and the cryptic error messages are of little help.

Once set up, however, the GatorBox works smoothly and reliably. And right now, it's the best option available.

**Rick Reynolds** *is executive director of the Bay Area NeXT group and owns a Macintosh and NeXT graphics service bureau in San Francisco.*

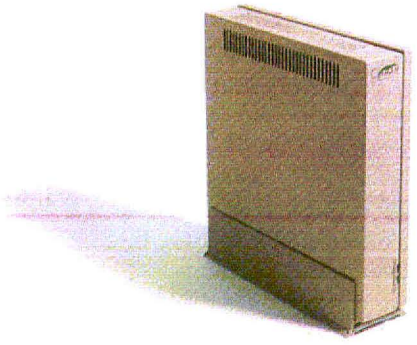
CONNECTIVITY

**GatorBox**

A gateway for linking TCP/IP networks (like the NeXT's) to AppleTalk or EtherTalk networks. The system is expensive and almost impossible to set up without extensive help from technical support. Once connected, however, it performs reliably. The GatorShare software is the key to its utility, mounting NeXT volumes into the Macintosh filing system and enabling easy file transfer between platforms.

$2795 for basic configuration, $595 for GatorPrint, $1995 for GatorShare (includes GatorPrint), $995 for GatorMail (for ten users)

*Cayman Systems, 26 Landsdowne Street, Cambridge, MA 02139. 617/494-1999, 617/494-9270 fax*





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# DM-N Digital Microphone

by Robert D. Nielsen

NeXT computers are noted for their exceptional built-in sound processing capability. The NeXT's DSP (Digital Signal Processor) handles and outputs CD-quality sound (44.1kHz). Unfortunately, the only standard analog input available through the NeXT's built-in microphone or microphone jack is 8kHz mono (speech quality). When sound quality or frequency response range is important, users will need another tool. Digital Microphone (DM), from Ariel Corporation, is one item from a category of products, called A-D, that address this need.

DM is a digital microphone with the stereo analog-to-digital (A-D) converter built into the handle. Stereo inputs in the bottom of the microphone take care of input from other sources, such as a standard CD or tape player. LEDs indicate recording levels out of range. A cable leads from the microphone to NeXT's DSP port. Of course, the entire unit is black.

For normal speech quality, DM performs no better than NeXT's built-in microphone, but it does a great job of providing high-fidelity sound input at higher sampling rates (the choices are 5.5125, 11.025, 22.05, 44.1, and 88.2kHz). The top end here handles twice CD-quality sound. The omission of a rate of 8kHz, to match sounds brought in through the microphone jack, is a glaring oversight.

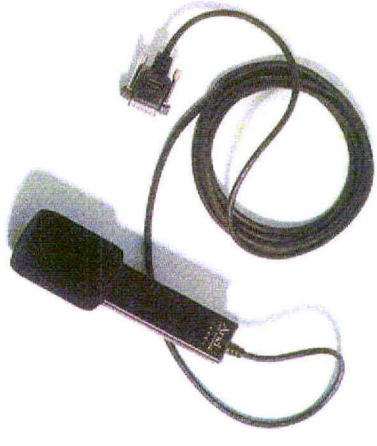
Though DM represents a solid piece of hardware engineering, the ergonomics of the unit are a disaster. The 1-inch by 1.5-inch cross-section of its handle makes it clumsy to use. The clipping LEDs at the bottom are impossible to see when talking into the microphone, unless you hold it upside down and let the wires hang in your face. And because Ariel's recording software gives you no visual response during recording, you're forced into this awkward position.

Ariel's documentation (printed) seems to be a joint effort between UNIX nerds and DSP nerds. (Ariel ships no on-line documentation.) On the whole, the book is great for technical folks but bad for average users. It refers frequently to the "UNIX man" pages, and if you don't know what that means, you will have a problem. Sections describing cable printouts and DSP commands make this manual truly intimidating. If Ariel wants its products to be used by real human beings, it should consider getting a professional technical writer to split the documents into separate user and hardware engineer sections.

Unlike similar products on the market, DM does not come with its own software. Several programs that monitor and control input into the DSP port are readily available. NeXT provides a stripped-down sound recorder with NeXTstep 2.0. A free alternative is Rob Poor's excellent RecordApp. Metaresearch's Digital Ears software is available with or without its hardware. (Digital Ears will be reviewed in a future issue of *NeXTWORLD*.)

It seems clear that Ariel is a great hardware company that realized late in the game that it needed documentation to sell with its product—and then it greatly underestimated the effort required to accomplish this task. DM is not a useful product as a professional microphone, but it is very useful as a straight digitizer, despite its drawbacks. However, the current problems could be fixed with relatively little effort, and then it would be a terrific product.

**Robert D. Nielsen** *is an independent software consultant and registered NeXT developer.*



PERIPHERALS

**DM-N Digital Microphone**

Hardware that supplies analog-to-digital conversion for high-quality, high-frequency sound processing. The microphone provides great-quality sound input, but Ariel gave very little attention to its ergonomics and the accompanying documentation.

*$595*

*Ariel Corporation, 433 River Road, Highland Park, NJ 08904. 908/249-2900*



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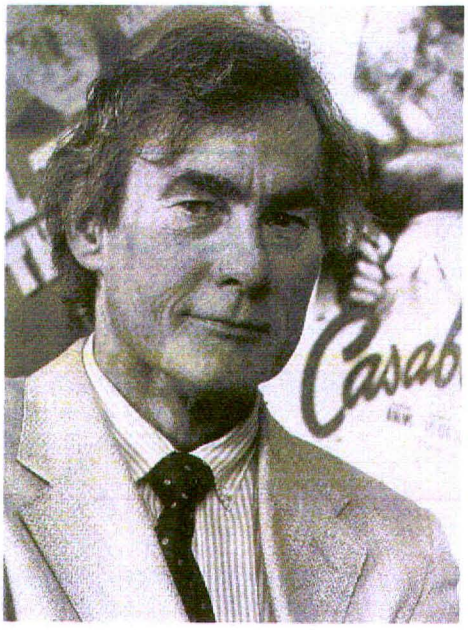

# Living Technology/Theodore Roszak

**In the Information Age, nothing has become more problematical than the meaning of *information* itself. In my youth the word was rarely used for anything more exalted than requesting a telephone number ("Information, please"); it now enjoys a mystique greater than reason, faith, or grace.**

Pondering "life and the final state of the universe," the renowned cosmologists John Barrow and Frank Tipler conclude in their recent book *The Anthropic Cosmological Principle*, "Everything human beings do, not just their thinking, is purely and simply a form of information processing. It follows that every conceivable thought and action of any possible form of life is ultimately constrained by the physical laws governing the processing of information."

Accordingly, they imagine a time when some superintelligent species will use positronium atoms to store "an infinite amount of information." And that will be "the instant the Omega Point is reached," meaning the kingdom of God. Behind this apotheosis of information there lies some fascinating cultural history. In the late thirties, mathematician Claude Shannon of Bell Laboratories brainstormed a new approach to the study of communication. He called it "information theory." His goal was to find a purely quantitative calculus for the transmission capacity of electrical systems. This meant stripping "information" of its commonsense association with facts: discrete, meaningful units of thought. That colloquial connotation nevertheless continued to cling to the word like lint. When challenged to justify the divergent meaning his theory ascribed to *information* (why hadn't he chosen, say, *signal* or *sign*?), Shannon agreed that his usage might be "more trouble than it is worth." But before he could find a substitute (he later favored "communication theory"), minds as potent as those of mathematicians Alan Turing and Norbert Wiener had launched *information* on an exuberant new career. Turing believed that machine intelligence was just around the corner; Wiener was convinced that his new science of cybernetics (a theory of control and communication in the animal and the machine) had harnessed one of the fundamental properties of life and mind: the transfer and feedback of information.

**Decoding life.** Meanwhile, in another part of the forest, a revolution was under way. In the early fifties, the biologists James Watson and Francis Crick had deciphered the double helix, and with it, or so they thought, the basic chemistry of genetics. But scientists work from paradigms, which they may explore, exhaust, or discard; the new biology was no exception. The biologist Stephen Rose observes in his book *The Chemistry of Life*, how rapidly "biochemists seized on...the new sciences associated with the development of computers in order to probe the ways in which the cell...regulates its own metabolism." It seemed so obvious that DNA was a "code," the double helix a "bit-string" stored in the "memory" of the cell, the gene a "biocomputer" that was "programmed" to process "data" stored in the amino acids. By now the rhetoric is so familiar that we may not realize what a fateful act of cross-fertilization this was.

As revolutionary as the new biology may have been, the adoption of the computer paradigm had one highly conservative effect on the field. It simply took the old mechanistic picture of nature and applied it to living organisms. The technology involved might be state of the art (now including sophisticated means of programming, interaction, and feedback), but the philosophical assumptions underlying the model were as



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antique as the Newtonian world-machine. There is an irony here. Just as the new physics of Bohr, Heisenberg, and Schrödinger was leaving its mechanistic legacy behind, the machine image was about to find a home in the new biology—and soon after that in psychology, which rapidly adopted the computer as a model of the human mind. By the mid-fifties, it was common for people to speak of the mind in terms of "memory tapes" and "feedback" mechanisms, and to refer to themselves as "programmed."

However much the new biology may have borrowed from cybernetics, it repaid the debt handsomely by lending to information a glamour it might never have acquired in any other way. In effect, information, a once humble and nondescript piece of intellectual furniture, became the secret of life. From a data-processing mechanism as tiny as the DNA helix, all the subtle complexities of life on earth had evolved.

John Pfeiffer, in his book *The Thinking Machine*, called it "automation at the molecular level." Here was an astonishing demonstration of how much could be pieced together out of mere particles of data. The mechanistic model of the universe had always needed a subtler, more ingenious analogy than steam engines and dynamos to communicate the elusive mysteries of life. Even the clock, that oldest of smart machines, had never quite filled the bill as a convincing replica for the "jellyware" of the brain or cellular chemistry. The computer, especially as it got smaller and faster, was just the machine to save the mechanistic paradigm from extinction. The paradigm was now, however, left suspended precariously above the physicist's invisible domain of fields and energies and baffling probabilities. This was hardly the firm foundation of solid matter on which mechanistic science had always hoped to be based.

**More than machine.** It remains to be seen how far the computer paradigm can be pressed in biology. If the living cell is any sort of information processor, its intricacy is vastly beyond anything the most sanguine cognitive scientist could imagine simulating. In order to make a genuine comparison, try to visualize a computer program that could reach out into the material world to transform the hardware that contained it into an automobile, an airplane, a high-rise apartment building, and could do so smoothly, promptly, with a perfectly fluid grace. That is, roughly speaking, what happens to an embryo as it matures from a lump of cells into a viable organism. Along the way it even recapitulates the phylogeny of its species. The complexity and evolutionary memory involved here go well beyond decoding a bit-string.

But if biology has begun to exhaust the value of the computer model, computer science is far from finished with the biological analogy. What other machine besides the computer was ever spoken of as going through "generations"? Even more dramatic is the use that information technicians frequently make of the evolutionary paradigm. Genes may or may not process information, but the notion that computers "evolve" is deeply entrenched. Nor is the term always used metaphorically. There are those who see mechanical intelligence as, quite literally, a species in the making, well on its way to becoming more fit to survive than its human inventor.

Hidden within this gleeful but usually serious line of speculation is a revealing fascination with the "cult of antilife," which Lewis Mumford, in his book *Interpretations and Forecasts*, identifies as the dark side of industrial culture. "With the further development of cybernetic controllers to make decisions on matters beyond the range of...conscious human calculation, post-historic man is on the verge of displacing the only organ of the human anatomy he fully values: the frontal lobe of the brain."

Consider for example the psychological implications of the following scenario: Information technology reaches a stage at which individual human brains can be fully simulated and then downloaded into microchips. The body becomes dispensable; personal identity becomes obsolete. The world becomes a population of immortal and "multipresent" mental phantoms preserved in robotic shells. "In the final step your old body is disconnected. The computer is installed in a shiny new one, in the style, color, and material of your choice." Science fiction? Not at all. This is what Hans Moravec of Carnegie-Mellon University predicts enthusiastically. Mathematician and artificial intelligence expert Marvin Minsky likes the idea, too. "It's hard to see anything against it," he comments. "People will get fed up with bodies after a while." Minsky has worked his way to the conclusion that life has become a disposable concept; the future of biology lies with energetics and information processing—in short, with thinking machines.

In 1978 *Time* magazine turned to Robert Jastrow of NASA to provide the big picture for its major issue on computers. Jastrow used the platform to predict human obsolescence. The future of life on earth, he was certain, lies with "the child of man's brain rather than his loins....Human evolution is a nearly finished chapter in the history of life....We can expect that a new species will arise out of man surpassing his achievements as he has surpassed those of his predecessor, Homo erectus....The new kind of intelligent life is more likely to be made of silicon."

Not that there might not be a payoff for humans before this "intelligence beyond man" ushers us into a well-deserved extinction. Like Moravec, Jastrow looks forward to the time when the brain will make its home in a cozy box. In his book *The Enchanted Loom*, Jastrow predicts that any day now "a bold scientist will be able to tap the contents of his mind and transfer them into the metallic lattices of a computer." This he views as "the mature form of intelligent life in the Universe," the point at which the computer liberates the brain from "the weakness of the mortal flesh" and turns us into "a race of immortals."

Under the guise of hardware and software, a mind-body dualism as old as Pythagoras repeats itself in our time. But now the once religiously motivated asceticism comes mixed with a Frankensteinian arrogance. And that is an algorithm for the making of monsters.

**Living Technology** *explores how information technology changes the way people work and live.*
**Theodore Roszak** *is a professor of history at California State University, Hayward. He is the author of* The Making of a Counterculture, The Cult of Information: The Folklore of Computers and the True Art of Thinking, *and the science fiction novel* Bugs. *His latest work of fiction,* Flicker, *"a secret history of the movies," will be published by Simon & Schuster this spring.*

# NeXTworking

by Daniel Miles Kehoe and Seth T. Ross

**Don't be fooled by the graphical user interface, the built-in networking, or the elegant black casing. The NeXT computer is an IBM PC clone.**

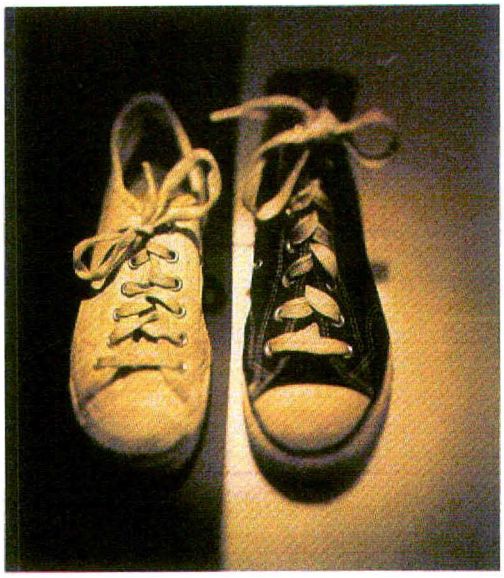
How does *NeXTWORLD* know? In preparing this issue's connectivity report, we plugged 3.5-inch and 5.25-inch floppy drives into the back of our Cubes and proceeded to run every PC application that we've bought, begged, or borrowed since 1982.

Why would we do such a thing? Other than for nostalgia's sake or a bizarre recidivism, you might think it ridiculous to use the NeXT, minus the richness of the NeXT interface, to run PC programs. Ridiculous, maybe, but realistic, for innovation must always exist alongside its own history. In the NeXT world, that history is DOS.

For practical purposes, business users still need their DOS applications and DOS-based data as badly as they need the potential power of the NeXT. NeXT recognized the need to clear a migration path for PC users by making NeXT computers as PC-compatible as possible (after all, NeXT needs business users!). NeXT has accomplished this by equipping every new computer with a DOS-compatible floppy drive. In addition, several vendors offer applications that ensure that DOS data will be accommodated by the NeXT.

Our first report in this issue's NeXTworking section tackles the problem of getting DOS or Macintosh files into a NeXT computer. There are a dozen different methods (see the table on the next page), ranging from Ethernet-based networks to the simple swapping of floppy disks. We begin a series of articles on the topic by looking at the simplest of PC-to-NeXT connections: file transfers via floppy disk. Future issues will take up more ambitious, cable-based connectivity.

The second report in this section looks at applications. Several application packages run on both the NeXT and a PC. Along with a handful of common file formats, this software forms the core of a transition strategy. Add Insignia Solution's SoftPC emulation software as a safety net, and any well behaved PC application will run on your NeXT computer. For more information on the NeXT-compatible products listed here, see Dock Soup in this and every issue of *NeXTWORLD*.



## Sneakernet

The PC-to-NeXT migration path has been paved by NeXT's decision to install a 3.5-inch, DOS-compatible floppy disk drive in its new computers. Disks can now be taken directly from a DOS-based PC to a NeXT via "sneakernet"—meaning Eliot copies his data onto floppy, walks down the hall, and passes the floppy to Tiffany. Despite the attraction of more advanced forms of network connectivity, the workaday world of file sharing is still dominated by the prosaic combination of shoe leather and floppy disks.

Does this mean that all NeXT users can assume easy data exchange with the tens of millions of working PCs and Macintoshes currently running in businesses and homes? Not quite yet. Unfortunately, oodles of DOS floppy-disk standards exist side by side: There are proliferating combinations of disk sizes and densities. Further complications could stymie users who need data from a Macintosh.

In this article, we'll look at how NeXT has incorporated PC-compatible floppy drives into its platform, and we'll consider the routes PC and Macintosh users can take to transport their data to the NeXT.

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## Options for data transfer from DOS PCs or Macintoshes

| | File transfer solutions | Possible from IBM PC? | Possible from MAC? | Requires extra hardware? | Requires extra software? | Notes |
|---|---|---|---|---|---|---|
| **Via Sneakernet** | 3.5" 1.4MB/720KB DOS-format floppies | yes | yes | no | no | Original NeXTcube requires installation of a hard drive and System 2.0 |
| | 5.25" 1.2MB/360KB DOS-format floppies | yes | no | yes | no | Needs DaynaFILE external drive |
| | 3.5" 1.44MB Mac-format floppies | no | yes | no | yes | Needs DIT FloppyWorks utility for NeXT |
| | 3.5" 800/400KB Mac-format floppies | no | no | yes | yes | Forthcoming product form DIT will allow use of these disks |
| | Syquest 44MB removable cartridge | yes | no | yes | no | Needs removable cartridge hard drive product |
| **Via serial cable** | Dataviz MacLink Plus/PC | no | yes | no | yes | Dataviz application requires Macintosh |
| | UUCP via Direct cable | yes | yes | no | yes | Needs DOS application for UUCP connection |
| **Via modems & phone line** | Telecommunications applications | yes | yes | yes | yes | Needs two modems and telecom software |
| | UUCP via dial-up connection | yes | yes | yes | yes | Needs application for UUCP connection |
| **Via Ethernet cable** | Telnet/FTP link via TCP/IP | yes | yes | yes | yes | Needs DOS or Mac software for terminal emulation |
| | NFS server network via TCP/IP | yes | yes | yes | yes | Needs DOS NFS client software or gateway |
| | Novell server network | future | future | yes | yes | Needs software to make NeXT a Novell client |
| | AppleShare Server network | future | future | yes | yes | Needs software to make NeXT an AppleShare client |

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- ❑ 12) NeXT
- ❑ 13) Unix workstation

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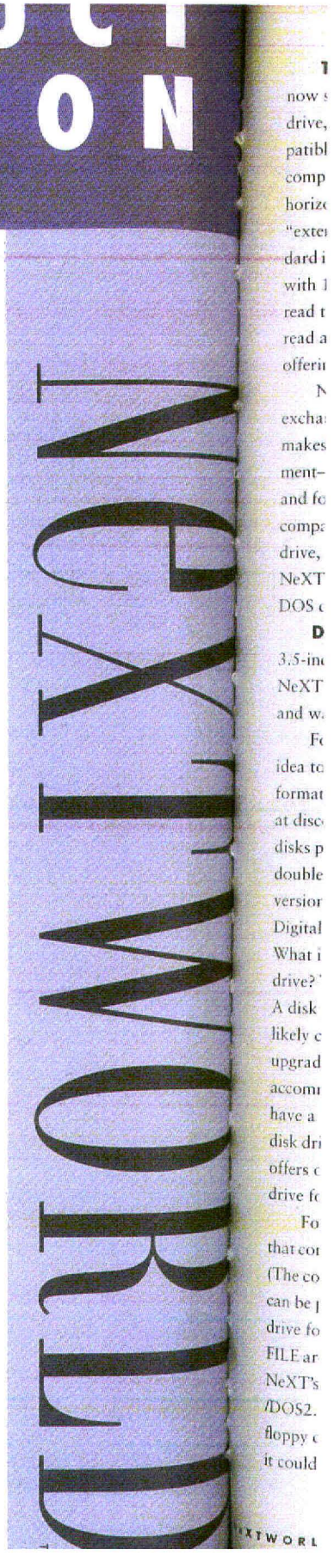


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**The NeXT floppy.** Every NeXT computer now ships with a Sony MPX-111N floppy disk drive, a 3.5-inch disk drive that is "upwardly compatible" with the drives found on DOS-based computers. The drives use vertical (as opposed to horizontal) magnetization to read and write "extended" 2.88MB floppy disks, the new standard in the NeXT world. Although DOS machines with 1.44MB and 720KB floppy drives cannot read the 2.88MB floppies, the NeXT drive can read and write to lower-capacity 3.5-inch disks, offering easy data exchange.

NeXT's commitment to floppy drive data exchange is also manifested in the software that makes up the NeXTstep 2.0 operating environment—software that has the ability to read, write, and format DOS-compatible disks. When a DOS-compatible floppy disk is inserted into a floppy drive, it is mounted in the file system as /DOS. NeXT applications can read from and write to the DOS disk as easily as they can with a NeXT disk.

**DOS formats.** If your DOS-based PC has a 3.5-inch disk drive, transferring data to the new NeXT is a breeze: Just copy the files to floppies and walk them over to the NeXT.

For PC-to-NeXT file transfers, it is a good idea to stock up on high-density 3.5-inch disks formatted for 1.44MB of data (about $1.50 each at discount stores) or lower-cost, double-density disks preformatted for 720KB. Here's a tip: Blank double-density disks are not recognized by early versions of external drives supplied by PLI and Digital Instrumentation Technologies (DIT). What if your PC doesn't have a 3.5-inch disk drive? The simplest solution would be to add one. A disk drive that can format 1.44MB disks will likely cost under $100. If your PC can't be upgraded (PC floppy controllers ordinarily accommodate only two drives), or if you don't have a PC on site, you can add a 5.25-inch DOS disk drive directly to your NeXT. Dayna Solutions offers one such solution, the DaynaFILE external drive for the NeXT.

For our tests, we evaluated a DaynaFILE unit that contained both 3.5-inch and 5.25-inch drives. (The combination lists for $1105; a 3.5-inch drive can be purchased alone for $850, and a 5.25-inch drive for $750.) Floppies inserted into the DaynaFILE are automatically mounted and appear in the NeXT's File Viewer, one as /DOS, and another as /DOS2. The drive performed well with a variety of floppy disks formatted on different PCs, although it could not handle 2.88MB NeXT floppies.

## Floppy drive solutions for DOS-based PCs

| Disk formats | NeXT built-in drives | Dayna Dayna-FILE | DIT Cube-Floppy 2.9 | Pacific Micro PM1.44 | PLI Super-Floppy2.9 | Notes |
|---|---|---|---|---|---|---|
| 3.5" 2.8MB NeXT-format floppies | yes | no | yes | no | yes | NeXT-formatted disks cannot be read by PCs |
| 3.5" 1.4MB/720KB DOS-format floppies | yes | yes | yes | yes | yes | Cannot format 720KB DOS disks on NeXT computers |
| 5.25" 1.2MB/360KB DOS-format floppies | no | yes | no | no | no | May be cheaper to add a 3.5" drive to a PC |
| Syquest 44MB removable cartridge | yes | no | yes | no | no | Suitable for large files in excess of 1.4MB |

## Floppy drive solutions for Macintosh computers

| Disk formats | NeXT built-in drives | Dayna Dayna-FILE | DIT Cube-Floppy 2.9 | Pacific Micro PM1.44 | PLI Super-Floppy2.9 | Notes |
|---|---|---|---|---|---|---|
| 3.5" 2.8MB NeXT-format floppies | yes | no | yes | no | yes | NeXT-formatted disks cannot be read by Macs |
| 3.5" 1.4MB/720KB DOS-format floppies | yes | yes | yes | yes | yes | Requests late-model Mac with Superdrive, Apple File Exchange |
| 5.25" 1.2MB/360KB DOS-format floppies | add s/w | add s/w | add s/w | add s/w | add s/w | Requires DIT FloppyWorks utility for the NeXT |
| 3.5" 800/400KB Mac-format floppies | no | no | future | no | no | The Mac Plus and early Mac SE can only use 800/400KB disks |



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**When files don't fit.** Although the new 1.44MB floppies can store larger files than ever before possible on a PC, you'll still encounter files that just don't fit.

If your PC and NeXT computer are at the same site, and you transfer large files regularly, it's time to give up on sneakernet and install an Ethernet-based network. The speed and convenience will justify the expense of the necessary PC Ethernet adapter card, cabling, and software.

If your PC and NeXT are not at the same site, try using a DOS backup utility that splits files between floppies. Run the same utility on the NeXT with the help of Insignia Solution's SoftPC (discussed below in "Sister Applications") to reassemble the pieces. If a file is just a little too big, it's best to use an archiving utility such as PKWare's PKARC to compress and restore the file.

**Macintosh to NeXT.** Unfortunately, the NeXT operating system cannot recognize Macintosh-formatted disks. Fortunately, late-model Macintosh computers support DOS-formatted 3.5-inch, 1.44MB disks.

Owners of the Macintosh Plus and early Macintosh SEs (ones that shipped before August 1989) are not so lucky. These early Macintoshes accommodate only 400KB or 800KB Macintosh-formatted disks. For the time being, owners of such machines must transfer files via serial cable, modem, or an Ethernet-based network.

Even if you have a late-model Macintosh, you'll find transferring files on disk more difficult than from a DOS-based computer. You'll need to write to DOS-formatted 1.44MB disks from your Macintosh, not native-format Mac disks. And since DOS disks appear as blank, unformatted disks when they are inserted into a Mac disk drive, you'll need to use the Apple File Exchange utility to read them. (You'll find the Apple File Exchange utility on the System Additions disk or the Utilities 2 disk that came with your Mac.) Alternatively, you can purchase the $89 Dayna DOSMounter, a Macintosh application that makes it easy to read, write, and format 1.44MB DOS disks from the Macintosh desktop.

A word to the wise. Although Macintosh hard drives are SCSI devices, don't try connecting a Macintosh drive to the NeXT's SCSI port to transport files. You will be able to make the connection, but when you do, the NeXT will attempt to initialize the disk in the NeXT format, destroying your files in the process. (The NeXT will ask you before it begins reformatting.)

Other solutions are possible with the addition of third-party products. This spring, Digital Instrumentation Technologies (DIT) will introduce an external drive and software system for the NeXT that accommodates 800KB and Macintosh disks, as well as 1.44MB DOS or Mac disks—but not, unfortunately, 2.88MB NeXT disks.

DIT provides another nifty solution in the form of a utility, named FloppyWorks, that allows your NeXT to read, write, and format 1.44MB Macintosh disks. It works both with the NeXT's internal drives and with external drives offered by third parties. DIT sells FloppyWorks either with the CubeFloppy 2.9 drive ($680) or as a stand-alone application ($250). Pacific Microelectronics includes a Mac-disk-reading utility with their PM1.44 external drive for the NeXT ($395 for drive and software). The company plans to release the software separately but has not announced a price.

**For the floppyless NeXT.** We can't forget that NeXT has been selling computers for the last two years that have no floppy drives at all. If owners of the original NeXTcube want to exchange data with new NeXT users or install commercial software packages (which will ship on floppy disks), they will need a floppy disk drive.

Two external floppy-drive products are suitable for the original NeXTcube: the CubeFloppy 2.9 from DIT (list price $520) and the SuperFloppy 2.8 from PLI (list price $499). Both the DIT and PLI products conform to the new 2.88MB standard. Two other external floppy-drive products, from Dayna Communications and from Pacific Microelectronics, do not support the new 2.88MB standard and thus will be of limited value for NeXT-to-NeXT file exchange.

**Beyond sneakernet.** If you've got a floppy disk and two compatible floppy drives, you can exchange files. There's no hardware to add, no network software to configure. If you use a PC or Mac at home and a NeXT in your office, transporting a file on floppy disk is as easy (or difficult) as remembering your lunch.

Of course, floppies are fumblesome. If a PC or Macintosh is close to your NeXT computer, it may be more convenient to add a simple serial cable (or even an Ethernet adapter), plus communications or networking software, and transfer data directly from machine to machine. Future NeXTworking coverage will address these alternatives.

### Caveat Ejector

DOS and Mac users should be aware that the NeXT operating system is far fussier about ejecting disks than DOS or the Macintosh system.

When a floppy is inserted into a NeXT floppy drive, NeXT "mounts" the disk and integrates it into the file system (this may take several seconds). Once a disk is mounted, there are two easy ways to eject it: You can use the Eject option in the Workspace Manager's Disk menu or you can drag the floppy icon from the File Viewer into the Recycler, which functions like the trash can on the Macintosh. Note that the operating system will not eject the floppy disk if any file on the disk is being used by any application.

Under no circumstances should you ever physically remove a floppy disk without properly removing it from the file system. Recognize, however, that if you forcibly eject a disk before the operating system has cleanly unmounted it, data on the disk may be damaged. The next time you insert the disk you will see an alert panel asking if you want to initialize or repair the disk.



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# Sister Applications

If every computer shared the same data and offered the same applications, moving from one computer to another would be merely commuting. It's not yet that easy. Once you bring a file over to the NeXT, what will you do with it? The subsequent key element in the migration between the NeXT and other platforms is application compatibility.

If the same applications were available on the NeXT as on the original platform, files created on one machine would instantly open on another, without any loss of information, even the most complex formatting. A user could go to work immediately, without any retraining. A document would appear on the screen (or printer) with as much similarity as the different equipment would allow. Right now, the biggest problem for any migrating user is the fact that applications are not identical on different platforms.

The good news is that several compatible—if not identical—"sister" applications exist on both the PC or Macintosh and the NeXT. In addition, several data formats that are supported across platforms provide a common language for the exchange of data. Finally, users can turn to SoftPC, an emulation utility from Insignia Solutions, which allows DOS applications (but not Macintosh packages) to run on the NeXT.

Given these three alternatives, is migration really practical? To find out, *NeXTWORLD* tested applications with imported data in four broad categories: text, graphics, spreadsheets, and vertical-market applications. We found traps and pitfalls, vanishing graphics, and a few other surprises. We also discovered that if users are willing to learn new tricks and recall a few tips, a successful migration is possible and practical.

**Words and formats.** Fortunately for PC users—and a few Macintosh users—WordPerfect has come to the NeXT. The NeXT version incorporates all the functionality of WordPerfect 5.0 for the PC or Mac, and files created on the different platforms are identical.

The only problem in switching platforms is working with a different interface. WordPerfect for the NeXT obeys all the graphical conventions of NeXTstep. All commands are accessed from a main menu rather than from function keys. Users must forget the keystrokes they learned in order to operate WordPerfect on their PCs and learn NeXT's keyboard shortcuts instead.

It's easy to work with graphics in the NeXT version of WordPerfect. To incorporate an Encapsulated PostScript (EPS) or TIFF (Tagged Image File Format) file into a WordPerfect document, you simply locate the graphics file in the File Viewer and drag its icon into the document. But this graphics proficiency offers another obstacle to migration: Graphics placed in your document on the NeXT will not appear when you return the document to the PC. EPS graphics print on your PC's PostScript printer, but most TIFF graphics are gone forever.

You may encounter another hitch when it's time to print your NeXT WordPerfect file from your PC. The NeXT computer supports PostScript printers exclusively. If you don't have a PostScript printer attached to your PC, you may find that the NeXT fonts differ from those available on your HP LaserJet, your Epson LQ-1000, or that brand X device your predecessor brought in. In such cases, expect changes in character widths, line endings, and pagination—and extensive reformatting. Strictly speaking, this problem has nothing to do with WordPerfect, but it illustrates the current obstacles to easy migration.

Users of WriteNow on the Macintosh are lucky. Operations are almost identical and formatting is preserved across platforms. If you use any other word processor, for example Microsoft Word or PC KrispWrite (the word processor that came free in a box of cereal) your migration solution may teeter on the capabilities of a lingua franca such as ASCII or rich text format (RTF).

Any word processing document created on the PC or Macintosh can be saved as ASCII text and read by Edit, WordPerfect, or WriteNow on the NeXT. The drawback of ASCII is its limited ability to record document formatting. You'll transfer text, but you'll lose margin settings, tabs, and font information like boldface and italics.

To overcome the limitations of ASCII, Microsoft Corporation has fostered RTF. Though it is supported by many NeXT applications, not all applications utilize the format fully. For example, WriteNow ignores RTF page dimension and margin data.

Interestingly, it is the more finely formatted desktop-publishing files that may most easily cross platforms. For example, files created for TEX, the academic community's high-end publishing application, can be easily transported among versions of the program found on DOS-based PCs, Macintoshes, and UNIX workstations, including the NeXT.

Frame Technology's FrameMaker, the most popular publishing package for the NeXT computer, has been ported to the Macintosh and to many workstations, though not to the PC. Frame offers format-translating "filters" that will read many word processing files in all their richness. If your ultimate destination is a Frame document, you'll need no other translation. You may even be able to transfer the bulk of a formatted PageMaker or Xerox Ventura Publisher document into FrameMaker by massaging "tagged text" into the Frame "Maker Markup Language" or by programming a "Maker Interchange Format" filter. This process, however, is arduous, and may not be worth your time.



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**Graphics interchange.** The world is waiting for a counterpart to WordPerfect for graphics. Adobe Illustrator, with versions for the PC, Macintosh, and NeXT (announced, but not yet shipping) may achieve hegemony. In the meantime, Adobe offers a lingua franca in the form of the EPS format. The NeXT's use of PostScript for all imaging means that EPS files created on PCs or Macs find a ready home in any NeXT application that supports graphics.

Before you begin migrating with EPS files, however, bear in mind that EPS graphics cannot be easily edited. It is possible to open and edit the files in NeXT's demo application Yap, but this option is reserved for those willing to hack PostScript code.

EPS graphics are transferred as ASCII text files. Keep in mind that on the PC, lines of text end with the ASCII CR/LF "invisible character" combination. In most Macintosh applications, lines end with the CR character. Traditionally, UNIX applications expect an LF character at the end of lines. PostScript code will become unreadable if end-of-line characters are not converted properly. Some applications make the conversion automatically, but some require use of a translation utility such as that provided in DIT's FloppyWorks. If no translation utility is at hand, troublesone EPS files can be cleaned up with UNIX utilities such as sed, a "stream editor."

Here's another tip: When exporting EPS files from Aldus FreeHand (a popular Macintosh illustration program), you'll have a choice of three picture formats: none, Macintosh, or IBM PC. Choose "none" if you want to use your files on the NeXT.

NeXT also supports TIFF. Not every application implements the TIFF in a uniform manner. A TIFF file created on a Macintosh or PC might work fine in a NeXT application but it might not work at all in another.

Very few PC graphics formats are supported on the NeXT, leaving out graphics generated by AutoCAD, GEM Paint, GEM Draw, GEM Graph, PC Paintbrush, or in CGM format. Ditto for two popular Macintosh formats: MacPaint and PICT. You'll need to hunt down applications or utilities that can translate these idiosyncratic formats to the TIFF or EPS common languages. Macintosh PICT files can be opened in FreeHand or Adobe Illustrator and exported as EPS files (though you may be reluctant to purchase a $495 application for this capability alone!). To work around this, you can capture PC graphics by running your application under SoftPC and snapping a screenshot using the NeXT's Scene demo application.

**Spreadsheet exchange.** Lotus Improv translates files from its PC sister application 1-2-3, while Informix's Wingz has sister applications on the Mac and for Microsoft Windows. All NeXT spreadsheets read the ubiquitous Lotus WK1 format, and Wingz will import or export Excel files.

Lotus 1-2-3 and Lotus Improv are functionally similar. In a sense, Improv wraps around a 1-2-3 core. That core is every spreadsheet you've ever created, or that can be exported to a 1-2-3 format. Lotus knew no one would buy a new spreadsheet tool if they were required to re-create their past work from scratch.

Lotus Improv offers distinct advantages over its PC sibling (see the review in the premiere issue of *NeXTWORLD*). But how do cell-related formulas in 1-2-3 worksheets translate to Improv's English-language formulas? With a little elbow grease. Improv makes a best-effort attempt at translation and will run a mechanically translated formula with no surprises, but the user must review and rewrite each formula if it is to become easily understandable. Don't begrudge the effort required. During this process, several early users of Improv turned up errors in their 1-2-3 spreadsheets that had lain dormant for years.

But 1-2-3 power users also rely on well-stocked libraries of macros for everything from calculating depreciation to setting up data entry screens. Improv does not support macros (at least in version 1.0). Put bluntly, this could torpedo any portability between 1-2-3 and Improv, if 1-2-3 macros are an essential part of your everyday business. Improv's broader features set and expanded library of financial functions may take the place of a few well-worn macros, but there are many macro functions that simply cannot be duplicated. This means that Lotus users must carefully weigh the benefits of migration to Improv.

Spreadsheets exchanged among versions of Wingz won't require the massaging that the Lotus 1-2-3 and Improv combination requires. But the ease of data exchange among Wingz users is offset by Wingz's lack of popular acceptance. Chances are, if you use Wingz, you'll still regularly save spreadsheets in Lotus 1-2-3 or Excel format.

**SoftPC, the universal solvent.** Of course, there are thousands of PC applications that do not speak a common data format and for which there are no sister applications on the NeXT. If you rely on a vertical-market application that is used only in the widget-working industry, don't worry, you can still migrate to the NeXT. The solution is the PC-on-a-disk from Insignia Solutions—SoftPC. Running SoftPC on a NeXT enables the machine to run any well-behaved DOS software.

SoftPC duplicates a hardware PC down to the quirkiest idiosyncrasy (for more information on SoftPC, see the review in this issue). There is a C: drive and a D: drive (limited to 32MB, just like DOS requires). There's a licensed version of Microsoft DOS 3.3 (and if you want, you can install DOS 4.0). There's your choice of EGA or CGA screens. There's also a full set of parallel and serial ports (connected to the NeXT serial ports or to any UNIX device, process, or file).

The only limit to SoftPC is a physical one. There are no slots to plug in PC bus cards, so if your software looks for a Western Digital Ethernet card, or a Truevision Targa board, it won't find it. But that shouldn't be an obstacle.

To solve the problem posed by different keyboards (the NeXT keyboard has no function keys, page up, page down, break, and other assorted keys), SoftPC presents a menu of keyboard equivalents. Quick-fingered PC operators are sure to find this kludgy, and we found that PC applications that eschew the function keys are best suited to SoftPC. Programs such as WordStar 6.0, which relies on Crtl-key combinations, and ProComm Plus, which relies on Alt-key combinations, fall into this category.

SoftPC is fasted with character-based applications. Graphics applications, such as Xerox Ventura Publisher or Aldus PageMaker under Microsoft Windows 3.0, run unacceptably slowly on older 68030-based NeXTcubes. On a 68040 NeXT machine, you may be able to clunk along. It's a truth we've always known: a PC clone—including the NeXT with SoftPC—is fine for character-based applications, but it's better to run graphics on something else.

How is DOS on the NeXT? Better than it was: We ran two or three applications at once and never needed to reboot the computer. It was clone heaven, and an afterlife that DOS may not deserve.

**Daniel Kehoe** *and* **Seth T. Ross** *are* NeXTWORLD *contributing editors.*



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# The NeXT World

Edited by Dan Lavin and Charles L. Perkins

**New machines, new users, and new software have the NeXT community buzzing. Our user group section in this issue reports generally on user group activities around the country. In coming months we'll reprint news from group newsletters and activity reports. Thanks to Conrad Geiger, user group guru from NeXT, for collecting the news this month. This month's report from comp.sys.next shows the growth of that newsgroup and the excitement generated by the new machines. This section is your ear to the ground.**

## User Groups

The NeXT user group community is growing faster than the installed base—an indication that many people out there have just ordered one of NeXT's new products. Six months ago, NeXT counted 35 NeXT user groups worldwide. Today there are more than 70. Groups are located in the United States, Canada, Mexico, Japan, Australia, France, Sweden, and the Netherlands. Their combined membership tops 5000.

One of the newest groups, SCaN (Southern California Area NeXT Group), has had regular meetings at various locations around Los Angeles to accommodate the five NeXT groups in that area. SCaN president Michael Mahoney will have an IBM RS/6000 at the February meeting to show off NeXTstep. The December SCaN meeting featured the 22-minute new product video that NeXT has provided to all groups.

Many of the new groups have started in locations where there had not previously been many NeXT machines. These groups, such as the Texas A&M group, have as many as 40 to 50 members now. Other groups, like the San Diego group, have been working to set up electronic bulletin boards for group access.

Bill Parod of the Chicago group reports that they are planning a 24-hour user access room with a NeXT for their members. Following a national trend, they see a bigger emphasis on user, as opposed to developer, issues in their meetings.

NeXT has effectively made developers aware of the existence of user groups, resulting in memorable meetings with WordPerfect, Oracle, Frame, and Lotus, and new companies such as Objective Technologies, RightBrain Software, and Lighthouse Design.

## comp.sys.next

Watching the net news fly by is a wonderful way to find out things as they happen, often before they are announced and certainly before newspaper accounts confirm them. Of course rumors abound, but the experienced news reader can usually sniff out the real thing. In the past few months, we've had news when Release 2.0's golden master was cut and began duplication, and when 2.0 software upgrades and their 68040 hardware counterparts began to arrive. We got early announcements of the new 200MB drive (for buyers who want Release 2.0) and of the substitute 400MB drive and the discontinuation of the 340MB drive (for buyers who want Release 2.0 Extended), the first dribbling shipments of the new 68040 hardware (including some as early as November 30 of last year), and volume shipments of the new machines, which began as early as December 15 and have continued ever since.

Note: *NeXTWORLD* does not vouch for any of the products or services mentioned here; treat this information as you would any on-line posting.

**Memory.** Some comp.sys.next correspondents have tried various configurations of the new SIMMs. The rule seems to be, mix and match in sets of four SIMMs and you'll be fine. You can mix 1MB and 4MB SIMMs, different memory speeds, and even parity and nonparity memory (errors during self-test can be ignored). Also, be sure when ordering 4MB SIMMs to specify *ultra* low-profile, since many low-profile SIMMs are still too high to fit properly into the NeXTcube. A sampling of prices for 1MB SIMMs: $43 from Peripheral Outlet in Oklahoma, at 800/332-6581, and $45 from Micro Electronic Technologies, at 800/766-SIMM. Prices of 4MB SIMMs have been dropping since December, from $195 to $193 to $189, the most recent price posted for Peripheral Outlet, at 800/332-6581. Be sure to ask, when ordering from any company, whether it is certain its SIMMs will work with the NeXT computer.

**Disk drives.** An ongoing discussion about third-party disk drives has continued these past few months, with about an equal number of successes and horror stories. The bottom line seems to be that unless the disk drive you want to buy is already listed in NeXT's /etc/disktab file, or is known by a friend to work with the new 2.0 BuildDisk, caveat emptor. Of course, if you eat disktab entries and SCSI sense modes for breakfast, then you can order just about any mail-order disk drive, use the new 2.0 command "sdform" (or any other low-level formatter) to format it, and build a new disktab entry for it yourself. The new and supposedly automatic one-partition build of any SCSI disk supplied with 2.0 is known to fail for several drive types. Even if it's successful, it will take some knowledge of UNIX to complete, since the /etc/fstab shipped by NeXT assumes two partitions. For less experienced users, third-party hard-drive solutions are starting to emerge.

**The X in NeXT.** Continuing X Windows vs. NeXTstep wars have heated up, with many newsgroup posters questioning NeXT's strategy and intentions regarding X support. Although many agree that NeXTstep is superior in most categories of comparison, interoperability across platforms was considered by many to be justification for a good X port. Several NeXT employees even wrote directly to one poster to clarify that NeXT's position was not to discourage all X implementations (showing NeXT's laudable network presence). Most discussions ended when the announcement of a $149 commercial server by Pencom Software was posted. Free versions of X had existed for the NeXT but were not yet robust.

**Performance.** Along the same vein, Sun vs. NeXT vs. DEC vs. IBM benchmark and price/performance arguments have continued, with more data coming in daily. Everyone seems to agree that NeXTdimension is by far the best buy for a high-end color workstation, but without solid SPECmarks, Whetstones, Dhrystones, or LINPACK numbers, no one can be certain exactly where the 68040 NeXT belongs. It is generally agreed that it can beat out the SPARC-1 and 1+, some show it beating the DECstation 3100 in raw speed by more than the differential MIPS rating, and many show it below the MIPS and RS/6000 series. For compar-



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ison of the type of speeds being measured, one posting placed the NeXT at eight to ten times the speed of the Macintosh IIci. In price/MIP, the NeXTstation comes out on top by almost any measure. NeXT appears to have been conservative in its ratings of the new machine, claiming the low ends of the 15–20 MIPS and 2–2.5 MFLOPS ranges published by Motorola; recent postings indicate as much as 17 MIPS. (See "Station to Station" in this issue for *NeXTWORLD*'s benchmarks.)

**Net news.** Many posters were curious about acquiring network connectivity at home. Several options were discussed and are summarized here. UUCP, a simple store-and-forward mail and file-transfer system, is included with every NeXT but is not officially supported. If you or a friend have a lot of UNIX experience, and you have a friendly UNIX machine on the network nearby, getting mail access to the network is free. If you aren't an expert, full UUCP service is provided by Portal Communications, at 408/973-9111, for $34.95 per month plus $1.95 per hour of connect time. Other providers include Los Angeles's UUNET Technologies and CERFnet's DIAL n' CERF. For more interactive, direct Internet connections, you must have SLIP, or Serial Line IP, the internetworking protocol (IP) in TCP/IP. SLIP is currently unavailable in 2.0, and exists for 1.0 only in an unsupported under-the-table version. With SLIP software for your NeXT, the machine on the other end of the Internet must be running SLIP, too. Several third parties and some net posters have mentioned implementing SLIP for 2.0, but none has done it yet. NeXT has mentioned that SLIP (or PPP, a fancier version of SLIP) may be included in 3.0. Lack of SLIP support is a major shortcoming of 2.0. Without it, Internet connections are possible only at the office and not at home.

**In search of ODs.** Over the months, several possible supplies of cheap optical disks for the NeXT have emerged. NeXT itself, at $149 per disk, remains the cheapest official supply of single-sided ODs, but special deals with Canon and its various distributors have led to occasional price deals as low as $80 per OD. If you want to ask about ODs, call NeXT, Mass Micro Systems (Northern California), or MicroNet Technology (at 714/837-6033). Mention Canon optical drive model MO502M when ordering. One big surprise: *two-sided* ODs are now available for $188 from Maya Computer, at 800/541-2318. Vouched for by posters on comp.sys.next, they probably offer the best prices, since you get 512MB of usable storage for about the same price as the 256MB on the standard single-sided ODs. Kudos to Brad Gulko (turing@saturn.ucsc.edu) for his tireless efforts in tracking the wily OD for comp.sys.next readers.

**Backwardly speaking.** Various netters posted that they had seen SoftPC (the PC emulator for the NeXT) running on '040 hardware at about 10MHz AT speeds and report that it looked like a real, finished product (a little glitchiness in the screen updates might be due to its Beta status). Dave Hull (quark@asylum.sf.ca.us or 408/522-7604) is NeXT's support person for SoftPC. He posted this as its features: 80286 CPU and 80287 FPU (both real mode only); 640K RAM; EMS 4.0 expanded memory; CGA or EGA video; Microsoft Mouse; 101-key keyboard; COM1, COM2, LPT1, and LPT2; 2 MS-DOS hard drives (C & D); multiple FSA disk volumes; generic ASCII terminal driver. Another poster plans to write an ADI display driver for Insignia's "video" system (emulation, of course) and that "the rep for Insignia told me that it runs rings around the SPARC version, for some reason. I didn't get into why that might be."

**Here and there.** Here are some other small items mentioned in the net discussions:

- Rumor has it that NeXT is finishing Interface Builder's Database Kit and will be distributing it at cost.

- Many postings about NeXTdimension questioned its apparent video resolution limitation of 640 x 480, but others showed excitement about the announcements of frame-editable and computer-controllable home VCRs on the horizon.

- NeXT has made NetInfo sources available at cost. This supplements the GNU sources already available at cost, and the Mach sources, which cost $10,000 due to licensing issues. Now NetInfo has a chance to become a de facto standard like NFS.

- New Usenet news reader applications supporting RTF (rich text format) are being written, though acceptance of this brave new world is slow in coming even in comp.sys.next.

- An exciting extension to Draw that allows for multiuser interactions and conferencing is available from jfreem@uncecs.edu (Joe Freeman), heralding the start of truly interpersonal applications on the NeXT.

- The new NeXT keyboard shipping with the new hardware has been given consistently low marks by the UNIX/hacker community; loss of some useful special keys from the main keyboard and a cheaper feel are the main complaints.

- Distribution strategy reared its ugly head again: Many users have no floppy disk drive yet but are expected to receive all future software that way, even from NeXT. Cheap floppy disk drive solutions still do not exist.

- The TEX in Release 2.0 is version 3.1 and includes a good version of dvips.

**Dan Lavin** *is technology editor of* NeXTWORLD *and co-director of the Boston Computer Society (BCS) NeXT group.* **Charles L. Perkins,** *a senior associate with Marble Associates, is a contributing editor to* NeXTWORLD.

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# NeXT Question

Edited by Bruce Blumberg and Eric Larson

In this department we provide answers to your questions about the NeXT, along with helpful hints and tips. Because we had to prepare this column before the first issue hit the newsstand, we had to glean questions once again from our archives, from NeXT's publication *NeXT Answers*, and from asking around.

Our third issue will feature your questions. Please send them to NeXT Question, *NeXTWORLD*, 501 Second Street, San Francisco, CA 94107, or by e-mail to dlavin@nextworld.com.

## FOR USERS

**Q. How can I customize the login window?**

A. The original TIFF file for the login window is in /usr/lib/NextStep/nextlogin.tiff. Here are the instructions to customize it:

Open a Shell or Terminal as root and run the following commands:

```
myhost#cd /usr/lib/NextStep
myhost#cp -p nextlogin.tiff nextlogin.tiff.orig
myhost#open nextlogin.tiff
```

The last command will launch Icon. You can use Icon to edit the TIFF file that makes up the login screen. However, the new TIFF file should have the same dimensions as the original and should have no alpha channel. The new one should also include white fields for entering text in the same places as the original.

You can place the new TIFF file in the directory of your choice. To notify the WindowServer of the new location of the file, run the following command in a Shell or Terminal as root:

```
myhost#dwrite loginwindow ImageFile /me/mylogin.tiff
```

where */me/mylogin.tiff* is the path and filename of your login TIFF file.

**Q. Of course I love the British woman in my printer, but on the off chance that I ever get tired of her, how can I change the voice alerts for my printer?**

A. The voice alerts are in the directory /usr/lib/NextPrinter. There are four of them:

**manualfeed.snd** "Your printer is waiting for paper."
**nopaper.snd** "Your printer is out of paper."
**printeropen.snd** "Your printer cover is open."
**paperjam.snd** "Paper is jammed in your printer."

These are ordinary CODEC-based sound files (the standard NeXT microphone input). You can replace them with your own recording. Just record a sound, using any sound-recording program (such as SoundPlayer, a NeXT developer demo program that comes with NeXTstep 2.0 Extended) and name it something like /usr/lib/NextPrinter/manualfeed.snd. (The execute bit need not be on.)

**Q. When I click the Close box in a WriteNow document without saving the file first, a Save panel appears, asking if I want to save changes first. One of the options in the panel is Save/Compact. What is that option for?**

A. WriteNow preserves the previous version of a document in the .wn file, along with the changes from that version to the current version. This enables WriteNow to "undelete" text. However, to save disk space, or, for security reasons, to ensure that deleted text is really gone, you can use the Save/Compact option, either by clicking that button in the alert panel or by holding down the Alternate key while you save (Alternate-Command-s). Note that after you've done this, the Revert to Backup command in the Document menu is dimmed. The backup copy is no longer available. When you close the file, you will see a panel come up briefly, saying, "Reclaiming space in document."

## FOR DEVELOPERS AND ADMINISTRATORS

**Q. Is 1.0 NetInfo compatible with 2.0?**

A. 1.0 and 2.0 NetInfo are functionally completely compatible—you can mix 1.0 and 2.0 NetInfo servers as you wish. However, there is a difference between 1.0 and 2.0 NetInfo databases. 1.0 NetInfo data files are upwardly compatible to 2.0, so that you can move a NetInfo database from system 1.0 to 2.0, but you cannot move a file from system 2.0 to 1.0.

**Q. The Services menu in NeXTstep 2.0 applications provides hooks for applications to "publish" functions that can be used in other programs. Can you give a quick overview of how this is done?**

A. The following excerpt, from a NeXT "White Paper" by Bruce Blumberg, discusses developing applications under and porting them to 2.0. It should answer your questions. Warning: This is a rather lengthy discussion, geared to the technically knowledgeable.

### Services

A new facility has been added to the Application Kit to support a specific type of interapplication communication called Services. An application provides a service to another application by performing some operation on data that the other application passes to it via a pasteboard. A user invokes a service by choosing a desired service from the Services menu. The application then performs some operation on the data contained in the pasteboard, such as finding its definition or performing OCR (optical character recognition) on TIFF data.

The neat thing about the way Services has been implemented is that as long as the application providing the service accepts a standard pasteboard type, the requester need not know about the service in advance. Services that accept a particular application's pasteboard type will automatically show up in the Services menu. In addition, the only menu items that will be enabled at any given time are those services that accept the pasteboard types provided by the firstResponder or one of the objects in the Responder chain in the key window.

You can choose whether you want your application to simply be a client of services provided by other applications, or whether you want it to provide services to other applications as well.



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What should become a service? Services are not intended as a replacement for either Copy/Paste or Speaker/Listener. Services are intended for situations in which your application will perform one atomic operation on the provided data, such as including a document in an e-mail message.

Operations that can be described as a verb in a menu item (for example, Define) are excellent candidates. Operations that require additional arguments, or weird pasteboard types, are not. After all, one of the key advantages of Services is that if you provide a service for a standard pasteboard type, most applications will be able to take advantage of your service automatically. If, however, you define a unique pasteboard type such as MyWickedExcellentPasteboardType, there are going to be very few applications indeed that will have your service in their Services menu.

Being a Services client comes without requiring significant extra coding whenever you have a Services menu and the firstResponder is an instance of the Text class. If you have other objects that can be selected by the user, copied and pasted, and represented on the pasteboard via a standard pasteboard type, then it shouldn't be difficult to add the necessary support to act as a Services client. To be a Services provider requires a bit more work, but just think of the marketing advantages of having the user see your application's name in every Services menu on the machine!

Although the Appkit release notes describe Services in some detail, here is a quick overview: An application publishes the services that it is willing to provide by adding a __ services section containing a description of its services to its __ICON segment of its executable. Note, if your application simply acts as a Services client, you obviously don't have to do this. This information is digested by the Workspace Manager at log-in time and is made available to other applications. Included in the description of the service are the pasteboard types on which the services can be performed.

On the client side, the Application object is responsible for managing the Services menu and invoking the appropriate service when the user selects an item from the Services menu. In order for this to work, the Application object relies on objects that are willing to provide data to services to do a couple of things. First, objects within your application that are willing to provide pasteboard data to Services must register the pasteboard types they are willing to send and receive (done via the registerServicesMenuSendTypes:andReturnTypes: method of the Application object). Typically, these will be objects that support selection by the user, and this will be done at start-up. Only services that accept and return these pasteboard types will appear on the Services menu.

Whenever the firstResponder changes in the key window, the Application object sends validRequestorForSendType:andReturnType: down the responder chain to see if a responder is willing to provide, and possibly receive, a given combination of pasteboard types. Based on this information, it will enable or disable the menu items in the Services menu. When the user chooses an item from the Services menu, the Application object sends -writeSelectionToPasteboard:types: down the responder chain, and the object should then write the selection out to the pasteboard. The Application object then uses Speaker-Listener to send a message to the servicesListener in the application that advertised the service, and the services Listener in turn sends a message to its services Delegate, passing the ID of the pasteboard containing the data. It is up to the servicesDelegate to perform whatever service was advertised.

Thus, to be a Services client you must:

1. Add a Services menu item to your main menu. The easiest way to do this is to use Interface Builder and just drag one in.

2. At start-up, send -registerServicesMenu SendTypes:andReturnTypes: to NXApp, specifying the pasteboard types you are willing to send and receive.

3. Implement the -validRequestorForSend Type:andReturnType: for any object that is willing to write data to a Services pasteboard. Note this method takes arguments of type NXAtom. An NXAtom is simply a reference to a unique string, and thus NXAtoms may be compared directly. You use the NXUniqueString() function to create an NXAtom. Here is a simple example:

```
-validRequestorForSendType:(NXAtom) sendType
andReturnType:(NXAtom)returnType
{
NXAtom a;
a = NXUniqueString(NXFilenamePboard);
return (a==sendType)? self :nil;
}
```

4. Implement -writeSelectionToPasteboard:-type:. NXApp will use this method to request your object to write its selection to the pasteboard when your object is the firstResponder and a Services menu item is chosen.

This object will also receive -readSelectionFromPasteboard: if it should replace its selection with data returned by the Services provider.

Note: The Text object has been modified so that it will perform the activities listed in items 2, 3, and 4 automatically, so you get Services "for free" whenever a Text object is the firstResponder in the key window, as long as you have added a Services menu item to your main menu.

To be a services provider you must:

1. Add a description of the services you wish to provide to your executable. (Note: You can tell my roots to advertise first, then implement!!!) See the Appkit release notes for details, but essentially this will require you to create a text file containing the necessary information and editing your ICONSECTIONS line in your Makefile to look like the following:

```
ICONSECTIONS =-sectcreate __ICON app /usr/
lib/nib/default_app_icon.tiff\ -sectcreate __ICON
__services /path_to_your_description_file
```

or create a file called makefile.preamble, add the following line, and include that file in your project directory:

```
LDFLAGS = -sectcreate __ICON __services /path_
to_your_description_file
```

2. Designate an object as the object to which the servicesListener should send any Services messages that come in via -setServicesDelegate:. Note that part of the description of the service is the name of the port (for example, Webster's) on which a listener will be listening. This listener, which I have referred to as the servicesListener, will typically be the default appListener for the application, but it can be another listener if you wish.

3. Implement the appropriate method or methods for your Services delegate. Once again, part of the description of the service is the partial name of the message to be invoked. Methods that respond to Services requests are always of the form -methodname:userDatA.error:, so you only need to provide the first part, or unique part, of the complete method name (such as methodname in the example just cited).

The exact details for all of the procedures just discussed, as well as for the many options available, can be found in the Appkit Release Notes. Once again, we strongly encourage you to take advantage of this new facility.

**Bruce Blumberg** *was the first employee hired at NeXT. He was involved in many fundamental design decisions regarding the NeXT machine and its software.*
**Eric Larson** *is a member of NeXT's customer support group.*



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# Product Showcase

Turn here every issue for the latest-breaking, most interesting products in the NeXT™ marketplace. This is an exciting time for NeXT users. Development is exploding. The NeXTstep environment is proving to be a spawning ground for unique products. These ads keep you abreast of the best of what's out there. Showcase ads provide you with concise, easy-to-use information. Every one includes a picture, product information, and a handy reader service number. All this in 1,075 words (picture = 1,000 words + 75 text.)

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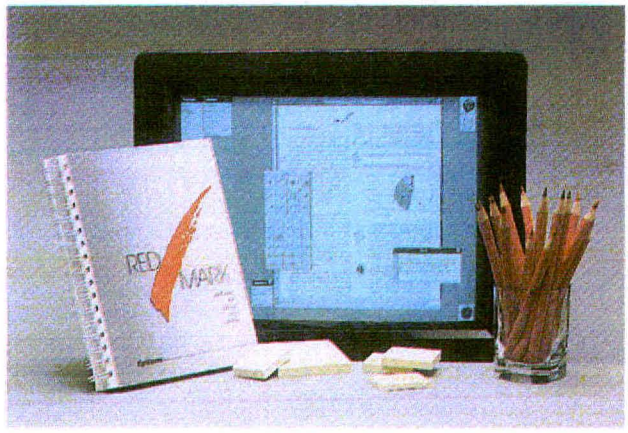


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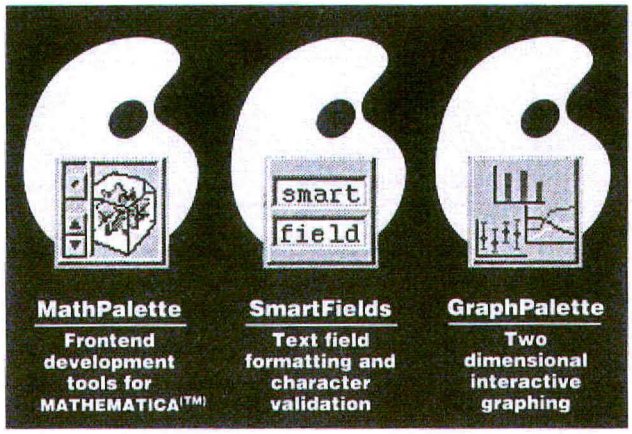


Call Objective Technologies today for more information about the most innovative palettes ever created for NeXT.™ Increase your development power. Save money by reducing your development time using objects created by the only commercial developers of custom palettes for NeXT's Interface Builder.

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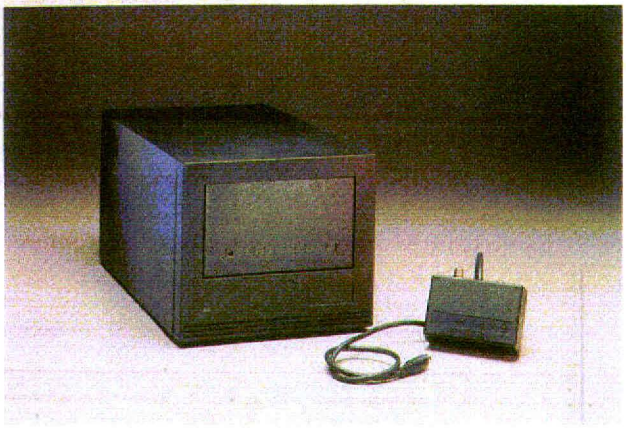
## Accessories for those taking the cube route . . .



We are committed to providing high-quality, low-cost add-ons to the NeXT™ computer. All are fully guaranteed to work with your NeXT. Hard drives: Pre-formatted, pre-tested, plug-and-play Seagate Wren drives. Includes all cables, instructions, software, and unlimited 800# support. 660Meg $1995/$2195 1Gig $3295/$3495 (internal/external) Also: Inexpensive telecomm hardware to connect the NeXT to a phone line for voice mail, FAX, modem. Call for info. **1-800-CUBE-RTE**

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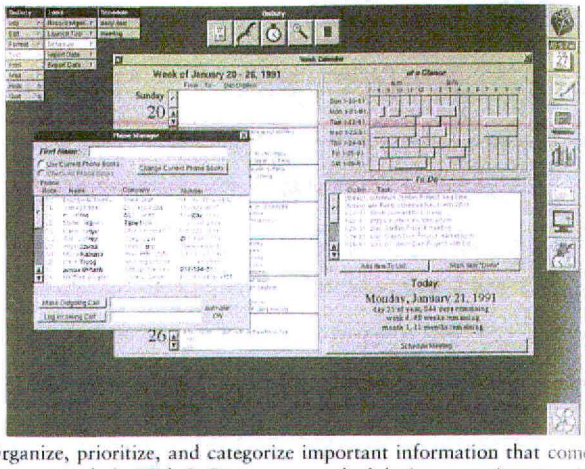

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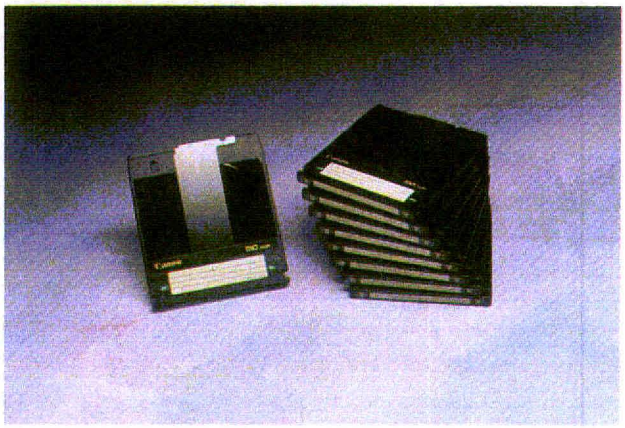

MicroNet offers you quality 512 MB dual-sided removable cartridges for NeXT rewritable optical systems. And that's not all we offer. MicroNet specializes in quality internal and external hard disk drives and tape backup for NeXT systems. Order your dual-sided cartridges and find out what's NeXT at MicroNet. Call today.

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## A/D64x A/D Converter

Hardware and software for high-quality sound recording and data capture on NeXT™ computers. Two-channel 16-bit delta-sigma conversion, 64 times oversampling, self-calibration, mic preamp with phantom power, balanced and unbalanced inputs. 32, 44.1, and 48 KHz (plus external) sampling rates. Multi-A/D64x synchronization. Digital (AES/EBU) input and output. NeXT software for recording, control, and editing. Stand-alone operation – replacement DAT recorder front-end, etc. Now shipping. $1295.

**Singular Solutions/959 East Colorado Blvd./Pasadena, CA 91106/(818) 792-9567**
**Fax (818) 792-0903**

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# Dock Soup

Dock Soup is a complete guide to third-party products available for the NeXT computer as of March 1991, according to the latest information available at press time.

The products reviewed in *NeXTWORLD* include the *NeXTWORLD* rating, as described below. Our reviews strive to answer the following three questions:

- What do products in this category attempt to do? This question frames the task the user needs to accomplish.
- What are the goals of this product according to its manufacturers, and how well does it accomplish those goals; that is, within its category, what specific problems does this product solve?
- Ideally, what might this product and category do? In other words, we judge the product also against an absolute concept of excellence rather than a relative one. In answering this question *NeXTWORLD* will serve as an advocate for change.

Our ratings are based almost entirely on the first two criteria. The third is used to suggest improvement and as a qualifier for our highest rating.

We avoid grade inflation. Very few products are awarded five cubes, and a good product gets three cubes, not four. Our reviews are independent, impartial, and fair. They reflect the combined judgment of the reviewer and the editorial staff. Unlike opinion pieces, bylined reviews are backed by, and are the responsibility of, the editorial staff.

For more information on any of the products listed here, call the manufacturer.

## The NeXTWORLD rating system

- **Best of Breed.** Solves a user's problem in innovative ways. Meets the highest goals for the category.
- **Excellent.** Very good by today's standards, but we can envision better.
- **Good.** Has some problems, but solves others.
- **Fair.** Merely adequate. Has some bugs.
- **Poor.** We don't recommend it.

## Business

### Boss Document Management System

This system addresses five major problems of work flow and document management on a network (what's going on, security, storage and retrieval, revision and configuration control, and notification) while preventing lost information and inconsistent revisions.

*$999 for single user, network prices vary. Boss Logic, 607 W. Broadway, Fairfield, IA 52556. 515/472-7740, 515/472-7787 fax*

### Calendoscope

An appointment calendar program for individuals or organizations. Appointments are listed by day, week, month, or year. Agendas and notes can be attached as documents. Appointment notification options include sound, pop-up windows, and e-mail.

*$95. Stained Glass Software, 1173 Kent Ave., Sunnyvale, CA 94087. 408/249-3337*

### Lotus Improv 1.0

(beta)

With a revolutionary model custom-made for data analysis, Improv is an essential spreadsheet for anyone doing financial modeling. Its first release, however, lacks such basic important features as an undo command and a macro language.

*$695. Lotus Development Corporation, 55 Cambridge Pkwy., Cambridge, MA 02142. 617/577-8500*

### OMEN III

A stock-quotation system incorporating client management, technical analysis, real-time news retrieval, and on-line order entry functions. Live connections to spreadsheets and analytical programs update linked charts, reports, and tickers. Provides voice and visual alerts when any security, currency, commodity, or index limits are reached.

*For price, contact Microstat Development Corporation. Microstat Development Corporation, 2150 Western Pkwy., Vancouver, BC V6T 1V6, Canada. 604/228-1612, 604/228-9793 fax*

### On Duty

A package of utilities for daily office tasks. Includes a phone directory; calendar and appointment book; scientific, office, date, and programming calculators; utilities for finding and comparing files; and windows for displaying the keyboard and ASCII character sets, launching applications, and indexing files.

*$295. Digital Instrumentation Technology, 901 18th St., #11000, Los Alamos, NM 87544. 505/662-1459, 505/662-0099 fax*

### PaperSight Light

A digital file cabinet that can be used on a stand-alone system or integrated network. Accepts and refiles documents from a variety of input sources. Text and voice annotations and markup overlays can be added.

*$695. Visual Understanding Systems, 3400 Forbes Ave., Pittsburgh, PA 15213. 412/488-3600, 412/687-7065 fax*

### PowerStep

(beta)

A capable spreadsheet, equipped with most of the power features pioneered by leading PC and Mac spreadsheets, marred by an Interface-Builder-gone-wild design.

*Price to be announced. Ashton-Tate Corporation, 21010 Hamilton Ave., Torrance, CA 90509. 800/437-4329, ext. 3717*

### TransManager 1.0

A transportation terminal management system for terminal operators, ocean and rail carriers, and port authorities. Provides graphic tools for managing cargo, equipment, and other functions. Can be used as a graphical front end to other existing automated systems that support terminal operations.

*For price, contact TransGraphics Systems. TransGraphics Systems, 3730 Mt. Diablo Blvd. #315, Lafayette, CA 94549. 415/283-5750, 415/283-5752 fax*

### Who's Calling? 1.0

A client-management system that imitates many routine office functions by combining relational database technology with simple file interfaces. Voice messages remind users to make phone calls and to announce appointments, while a message board sends text, voice, and images to others on a network.

*$495. Adamation, 1435 Center St., Oakland, CA 94607. 415/452-5252.*

### Wingz 1.1

A powerful, English-like programming language and stunning 3D graphics put this spreadsheet out front for users who care about those things. However, rudimentary file links and 2D files that make modeling difficult, and a clunky interface, make this a less than stellar entry.

*$699. Informix Software, 16011 College Blvd. Lenexa, KS 66219. 913/599-7100, 913/599-7350 fax*



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## Connectivity/ Communications

### AFS 3.1

A distributed file system for networks linking up to thousands of computers. Offers common file space for all users regardless of location. Equipped with a window for monitoring file server status, an on-line backup system, and various security features.

*Starts at $7000; discount for educational institutions. Transarc Corporation, The Gulf Tower, 707 Grant St., Pittsburgh, PA 15219. 412/338-4400, 412/338-4404 fax*

### Communicae

Software that enables NeXT computers to communicate with DEC and IBM mainframes and minicomputers and other information services. Permits communication with many graphics and CAD mainframe and minicomputer applications.

*$395. Active Ingredients, 222 Third St. #0234, Cambridge, MA 02142. 617/576-2000, 617/576-3609 fax*

### GatorBox

A gateway for linking TCP/IP networks (like the NeXT's) to AppleTalk or EtherTalk networks. The system is expensive and almost impossible to set up without extensive help from technical support. But once connected, however, it performs reliably. The GatorShare software is the key to its utility, mounting NeXT volumes into the Macintosh filing system, enabling easy file transfer between platforms.

*$2795 for basic configuration, $595 for GatorPrint, $1995 for GatorShare (includes GatorPrint), $995 for GatorMail (for ten users), $4990 for full deluxe configuration and extended warranty. Cayman Systems, 26 Landsdowne Street, Cambridge, MA 02139. 617/494-1999*

### GatorMail

A bridge between QuickMail or Microsoft Mail and any UNIX mail systems on SMTP networks, including Internet. Features mail exchange, aliasing, and data enclosures.

*$995 (10-user package). Cayman Systems, 26 Lansdowne St., Cambridge, MA 02139. 617/494-1999, 617/494-9270 fax*

### MacLinkPlus/PC

A kit containing more than 100 translators that transfer and translate files between the NeXT and Macintosh environments. Some of these translators provide a databridge between WriteNow for NeXT and many Macintosh word processors (such as MacWrite, Microsoft Word, WordPerfect, and WriteNow). Also transfers and translates data from DOS files accessed through the Macintosh desktop.

*$199. DataViz, 35 Corporate Dr., Trumbull, CT 06611. 203/268-0030, 203/268-4345 fax*

### MicroPhone II

A protocol script engine that automates users' communications. Provides custom front ends for e-mail and on-line research and data exchange, and Watch Me, an automatic script recorder that records for later replay.

*For price, contact Software Ventures Corporation. Software Ventures Corporation, 2907 Claremont Ave. #220, Berkeley, CA 94705 415/644-3232, 415/848-0885 fax*

### NeXTmail 2.0

NeXT's mail system, bundled with every NeXT machine, takes advantage of the machines' DSP to add a new layer—voice annotation—to current e-mail standards. Although some features are less than intuitive, the sytem works effectively to make multimedia communication almost effortless.

*Free with NeXTstep 2.0*
*NeXT Computer, 900 Chesapeake Drive, Redwood City, CA 94063. 800/848-NEXT*

### SoftPC

(beta)

A remarkably reliable, fast, and ingenious emulator that enables NeXT machines to run DOS PC software.

*$599. Insignia Solutions, 254 San Geronimo Way, Sunnyvale, CA 94086. 408/522-7600*

### 3270Vision

A powerful 3270 terminal emulator that allows IBM mainframe connectivity from the NeXTstep environment. 3270Coax is an adaptor box that connects the NeXT's SCSI port to an IBM 3174 or 3274 controller.

*$695 for 3270Vision, $2295 for 3270Coax. Conexions, 79 Wildwood Rd. #200, Andover, MA 01810. 508/475-5411*

### Worldtalk/400

An enterprise-wide messaging system that interconnects many existing messaging applications for computers with UNIX, OS/2, Netware, MS-DOS, and Macintosh operating systems. Compatible with other vendors' X.400-based messaging products and with European messaging standards.

*$5000 for Worldtalk/400 core; $3000 for Worldtalk/400 Gateway Engine. Touch Communications, 250 E. Hacienda Ave., Campbell, CA 95008. 408/374-2500, 408/374-1680 fax*

## Databases

### GatorShare

Software that resides in the GatorBox allowing file and data sharing between Macintosh and NeXT computers, transforming the NeXT computer into a non-dedicated file server for the Macintosh.

*$1995. Cayman Systems, 26 Lansdowne St., Cambridge, MA 02139. 617/494-1999, 617/494-9270 fax*

### INGRES Relational Database Management System

An application development environment providing 4GL, SQL, and visual programming methods. Created applications are instantly portable across multiple hardware platforms.

*Price varies. Ingres Corporation, 1080 Marina Village Pkwy., Alameda, CA 94501. 415/769-1400, 800/4INGRES, 415/748-2545 fax*

### MediaStation 1.2

A database for multimedia data acquisition and processing. Features include high-resolution image scanning, CD-quality audio recording, text processing, and frame-by-frame animation.

*$2500. Imagine, 32 N. Washington #14, Ypsilanti, MI 48197. 313/487-7117, 313/487-1323 fax*

### Objective DB Toolkit

An object library that bridges the gap between the Sybase database engine and developer applications. Provides extensive templating for TextFields and mapping of palette objects to database data types. Accommodates text, image, and sound data and supports text, buttons, and slider arrays.

*$995. Professional Software, 599 North Ave., Wakefield, MA 01880. 617/246-2425, 617/246-2443 fax*

### ORACLE Relational Database Management System

An RDBMS that simplifies application development and operation by implementing fourth-generation capabilities. Runs on more than 80 different computer platforms. Oracle applications and data move easily from one platform to another without modification.

*For price, contact Oracle Corporation. Oracle Corporation, 20 Davis Dr., Belmont, CA 94002. 800/345-3267*

### SYBASE SQL Server

Server software based on Sybase's SQL RDBMS. Features include client-server architecture to separate front-end and back-end functions, distributed data management, and the DB-Library SQL Server Interface to connect applications with the SQL Server.

*For price, contact Sybase. Sybase, 6475 Christie Ave., Emeryville, CA 94608. 415/596-3500, 800/879-2273, 415/596-4508 fax*

## Developer's Tools

### Absoft Object-Oriented FORTRAN 77 (v. 2.1)

A full implementation of the ANSI X3.9-1978 and MIL-STD 1753 FORTRAN language definitions designed for scientific and engineering users who want to port and develop programs from mainframe, mini, and workstation environments.

*$995; academic price $750. Absoft Corporation, 2781 Bond St., Rochester Hills, MI 48309. 313/853-0050, 313/853-0108 fax*

### ACUCOBOL-85

System software that produces machine-independent object code. Offers a multiple-version source control system, a split-screen interactive source code debugger for viewing, and interlanguage communication flexibility. Supports most features of Data General ICOBOL.

*$2995. Acucobol, 7950 Silverton Ave. #201, San Diego, CA 92126. 619/271-7097, 619/566-3071 fax*

### Allegro CL

A full-featured Lisp programming environment that is compatible with Objective-C, Interface Builder, and the Application Kit. A foreign function interface allows programmers to call FORTRAN and C routines. Also offers debugging options and generation-scavenging garbage collection.

*For price, contact Franz. Franz, 1995 University Ave., Berkeley, CA 94704. 415/548-3600*

### BugByte 1.0

A symbolic debugger for C and Objective-C programs. Provides a visual indication of the program counter, point-and-click setting of break points and display of variable contents. Examines program memory, variables, registers, signals, and stack frames.

*$295; academic price $195. ONyX Systems, 2325 Clareton Dr., Arlington, TX 76018. 817/468-2695*

### Displaytalk 1.0

An integrated development environment for Display PostScript programming. Useful for creating and testing pswraps during program development, and for



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designing and developing full-screen PostScript animation.
*$995. Adobe Systems, 1585 Charleston Rd., Mountain View, CA 94039. 415/961-4400, 415/961-3769 fax*

### Flexible License Manager v. 2.0

A network-wide, multiaccess package that allows software to be licensed on a concurrent-usage basis. Features include software that runs on any network node, enforced software expiration dates, demonstration software that can be licensed over the phone, and a log file that records all license transactions.
*$12,000 one-time binary license fee. Highland Software, 940 E. Meadow Dr., Palo Alto, CA 94303. 415/493-8567, 415/493-4506 fax*

### Macro Cross Assembler

A program that translates one or more source fields containing DSP instruction mnemonics, operands, and assembler directives into object modules that are relocated and linked by the DSP96000 Linker. Features functions for data conversion, error checking, and transcendental math.
*For price, contact Motorola. Motorola, Digital Signal Processors, MD: OE314, 6501 William Cannon Dr., West Austin, TX 78735. 512/891-2030, 512/891-2947 fax*

### Modula 2

A compiler that supports UNIX, Mach, and NeXT functions, as well as a set of standard libraries. Provides source code for the libraries and support for IEEE floating-point processing. Also allows the addition and modification of functions.
*$495. Jefferson Software, 20826 N. 16th Ave., Phoenix, AZ 85027. 602/869-0316*

### NeuExpert

A knowledge representation tool that combines expert system and neural network capabilities. Supports statistical rule analysis, uncertainty, graphic knowledge representations, backward chaining, and system learning. Limited object-oriented knowledge structures can be defined by the user.
*$25,000. Pacific Microelectronics, 201 San Antonio Cir., Ste. C250, Mountain View, CA 94040. 415/948-6200, 800/628-DISK, 415/948-6296 fax*

### NextBus Development Kit

Hardware and documentation for designing a NextBus board. Includes documentation for the NextBus and the NextBus Interface Chip (NBIC), preliminary information on writing loadable kernel drivers, two NBIC chips, a prototype board, and a disk containing related software tools and examples.
*$350. NeXT Computer, 900 Chesapeake Dr., Redwood City, CA 94063. 800/848-6398, 415/780-2801 fax*

### [OT Palettes: 1.0]

A family of custom object palettes for use with the Interface Builder application. Each palette combines objects of similar form and function, such as SmartFields, Chooser, and Math.
*Prices vary according to object. Objective Technologies, 7 Dey St. #711, New York, NY 10007. 212/227-6767*

### Oasys Compiler Family

A group of language compilers based on the Green Hills integrated family of compilers (C, FORTRAN, and Pascal). All the languages are inter-language callable. Offers procedural inlining, register caching, common sub-expression elimination, strength reduction, and loop unrolling. Provides full 68881, 68882, and IEEE floating-point support.
*$1500 per language. Oasys, 230 Second Ave., Waltham, MA 02154. 617/890-7889, 617/890-4644 fax*

### PaperSight Developer's Toolkit

More than 70 code and data modules to aid the VAR or turnkey developer in image management. Includes modules for scanning, fax input and output, image compression and decompression, image transformation and character recognition, text and voice annotation, annotation-based indexing, and voice help.
*$40,000. Visual Understanding Systems, 4300 Forbes Ave., Pittsburgh, PA 15213. 412/488-3600, 412/687-7065 fax*

### Simulator Programs

Two software programs to aid in the development of programs and algorithms running on the Motorola DSP56000 and DSP96000. The SIM56000 program emulates all of the functions of the DSP56000/1. The SIM96000 provides identical functions for the DSP96000 family.
*For price, contact Motorola. Motorola, Digital Signal Processors, MD: OE314, 6501 William Cannon Dr., West Austin, TX 78735. 512/891-2030, 512/891-2947 fax*

### UNIX MUMPS v. 3.1

A computer database and programming language specially suited for the interactive manipulation and storage of large volumes of medical and business data. Unlike conventional MUMPS (Massachusetts General Hospital Utility Multi-Programming System) implementations, UNIX MUMPS can be integrated into the UNIX environment and supports transparent, distributed, and heterogeneous networks.
*$595 for single user; $5500 for multi-user (one to four seats). Toltec Human Services, 5005 N. Pennsylvania Ave. #301, Oklahoma City, OK 73112. 405/840-4254, 405/840-3041 fax*

## Graphics

### Adobe Illustrator

A graphic design and illustration program that uses Display PostScript, and includes freehand, auto trace, geometric shapes, pen, and blend tools. Compatible with versions of Adobe Illustrator on other computer systems.
*$595. Adobe Systems, 1585 Charleston Rd., Mountain View, CA 94039. 800/344-8335, 415/961-3769 fax*

### ClickArt for NeXT

A collection of nearly 400 illustrations in EPS format. The Business Art segment includes images of office equipment and symbols for occupations, communications, and transportation. Other illustrations show people, animals, maps, sports, and food.
*$295. T/Maker, 1390 Villa St., Mountain View, CA 94041. 415/962-0195*

### Create!

(beta)

A full-featured Color PostScript drawing and paint environment for manipulating and adding special effects to graphic objects and text.
*$495; low-cost upgrade for TextArt owners. Stone Design Corporation, 2425 Teodoro N.W., Albuquerque, NM 87107. 505/345-4800*

### Diagram!

(beta)

A "digital whiteboard" that creates everything from organizational charts to annotated illustrations.
*$399. Lighthouse Design, 6516 Western Ave., Chevy Chase, MD 20815-3212. 301/907-4621, 800/366-2279*

### TopDraw v. 1.0

An object-oriented drawing package that integrates graphics, text, and raster images. Accepts EPS, MIF, TIFF, and RTF formats. Drawing objects include a spectrum of geometric shapes, with many object-fill properties. Text can be edited after applying graphic manipulations. Also features user-definable color palettes and spot color separations.
*$595. Media Logic, 2501 Colorado Ave. #350, Santa Monica, CA 90404. 213/453-7744, 213/453-9695 fax*

## Groupware

### Professional PaperSight

An image-management program for scanning, viewing, organizing, filing, searching, and archiving documents, and sending and receiving faxes. Overlays can be used for multiple layers of corrections, annotations, and written or recorded messages. Optional intelligent character recognition available.
*$1695; $1795 for character recognition. Visual Understanding Systems, 3400 Forbes Ave., Pittsburgh, PA 15213. 412/687-3800, 412/687-7065 fax*

### Redmark

A paperless review program that allows multiple reviewers to proof and critique documents by marking up a transparent overlay on the original. Annotation options include standard proofreading symbols, drawing tools, text, voice recordings, and imported graphics.
*$285. Epitome, 716 Summit Lake Ct. #100, Knoxville, TN 37922. 615/675-0910,615/966-2258 fax.*

## Peripherals

### Abaton Scan 300/GS

An 8-bit flatbed scanner that scans at resolutions of up to 300 dots per inch for line art, halftones, and 256 levels of grayscale. Saves files in TIFF format and will print to NeXT, Macintosh, IBM PC, and PS/2 computers.
*$1598 for 300 GS engine; $595 for interface kit. Abaton, 48431 Milmont Dr., Fremont, CA 94538. 800/444-5321, 415/683-2870 fax*

### A/D64x

An analog/digital interface for high-quality sound recording and data capture. Offers two channels of 16-bit, delta-sigma conversion, a microphone preamp with phantom power, and independent digital AES/EBU input and output.
*$1295. Singular Solutions, 959 E. Colorado Blvd., Pasadena, CA 91106. 818/792-9567, 818/792-0903 fax*

### Ariel QuintProcessor

A signal- and array-processing system that uses five digital signal processors to enhance the speed and versatility of the NeXT Music Kit. Can be used for array processing, music synthesis, speech recognition, and digital audio recording and mixing.
*$6995. Ariel Corporation, 433 River Rd., Highland Park, NJ 08904. 201/249-2900, 201/249-2123 fax*



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### Cube Digital I/O

A NeXTbus circuit card that furnishes 64 channels of digital I/O, a Centronics-compatible parallel port, and a breadboarding area for developing specialized electronic circuitry. The card has 32 bits each of input and output, and connects users' systems to a wide variety of printers and plotters, including standard IBM PC printers. AC and DC input and output modules available for direct connection.

*$745 Digital Instrumentation Technology, 901 18th St. #11000, Los Alamos, NM 87544. 505662-1459, 505/662-0099 fax.*

### Cube Floppy 2.9

An external SCSI 3.5-inch floppy disk drive that reads and writes to 3.5-inch disks used by computers with MS-DOS, Macintosh, and UNIX operating systems.

*$250 for floppy works; $520 for Cube floppy; $680 for package with software. Digital Instrumentation Technology, 901 18th St. #11000, Los Alamos, NM 87544. 505/662-1459, 505/662-0099 fax*

### DaynaFILE

An external floppy disk drive that enables NeXT computers to read and write to 5.25-inch, 1.2MB disks and 3.5-inch, 1.44MB disks. The DaynaDOS file transfer application permits NeXT, DOS, and Macintosh files to cohabit inside the NeXT file system and be opened and edited using various compatible NeXT applications.

*Starts at $750. Dayna Communications, 50 S. Main St. Fifth Floor, Salt Lake City, UT 84144. 801/531-0600*

### Digital Ears

A hardware/software package for entering, recording, and manipulating CD-quality sound and high-resolution laboratory data. Can be used for computer-based training, education, presentations, digital audio recording, voice therapy and diagnosis, speech and voice recognition, and acoustic research.

*$795. Metaresearch, 516 S.E. Morrison, Ste. M-1, Portland, OR 97214. 503/238-5728, 503/230-2627 fax*

### Digital Eye

A hardware/software package for entering and recording still and moving NTSC video images from many sources, including laserdisc players, video and still-video cameras, and VCRs. Features variable image size and resolution selections and software controls for image enhancement.

*$975. Metaresearch, 516 S.E. Morrison, Ste. M-1, Portland, OR 97214. 503/238-5728, 503/230-2627 fax*

### DM-N Ariel Digital Microphone

Hardware and software that supplies analog-to-digital conversion for high-quality, high-frequency sound processing. The microphone provides great quality sound input, but its ergonomics and the accompanying software and documentation got very little attention.

*$595. Ariel Corporation, 433 River Road, Highland Park, NJ 08904. 201-249-2900*

### Epoch-1 InfiniteStorage Server

An application- and platform-independent network server that communicates with heterogeneous computer networks. Equipped with fast magnetic disks that serve as a virtual cache while data is "staged" on and off to optical disk. Performs automatic, unattended on-line and remote system backup across a network.

*$82,900 to $694,000. Epoch Systems, 8 Technology Dr., Westborough, MA 01581. 508/836-4711, 800/US-EPOCH, 508/836-3802 fax*

### Extron Board

A board that allows NeXT computers to display video on a variety of compatible, large-screen data projectors or monitors.

*$2500. Extron Electronics, 13554 Larwin Cir., Santa Fe Springs, CA 90670. 213/802-8804, 800/633-9876, 213/802-2741 fax*

### Extron RGB 111

A computer-to-monitor interface that provides simultaneous local monitor viewing and an equally clear display on a compatible monitor or projector.

*$370. Extron Electronics, 13554 Larwin Cir., Santa Fe Springs, CA 90670. 213/802-8804, 800/633-9876, 213/802-2741 fax*

### IX-30F Image Scanner

An 8-bit flatbed scanner with a scanning resolution of up to 300 dots per inch and 4, 16, or 256 levels of grayscale. Saves images in EPS or TIFF formats with compression options. Has an automatic document feeder (ADF) option for OCR applications.

*$1545; $595 for ADF. Canon U.S.A., One Canon Plaza, Lake Success, NY 11042. 800/848-4123*

### JETSTREAM Tape Backup System

A backup program that uses standard 8mm removable and rewritable videotape cartridges. Archives up to 2.3 gigabytes of data per tape at speeds up to 14.4MB per minute. Error correction code ensures data integrity.

*$5995. Personal Computer Peripherals Corporation, 4710 Eisenhower Blvd., Bldg. A4, Tampa, FL 33634. 813/884-3092*

### LaSTLock

A hardware security system for the NeXTcube. Protects the monitor, keyboard, mouse, and Cube from tampering and theft. Attaches to a NeXTcube without bolts, screws, or glue.

*$195. Prevail, 3490 The Alameda, Santa Clara, CA 95050. 408/296-6550*

### OcéColor

A color thermal transfer printer capable of monochrome, 3-color, and 4-color printing using a wax-based ink ribbon. Outputs at 300 x 300 dots per inch. Comes with Pantone color simulations and 5MB RAM.

*$8990. OcéGraphics, 385 Ravendale Dr., P.O. Box 7169, Mountain View, CA 94039. 415/964-7900, 800/545-5445, 415/961-6152 fax*

### PLI SuperFloppy 2.8

A floppy disk drive that uses vertical recording to increase the capacity available in most disk drives from 1.44MB to 2.88MB. Compatible with 720KB and 1.44MB disk standards, allowing users to work with files from MS-DOS, OS/2, or UNIX-based systems.

*$499. Peripheral Land, 47421 Bayside Pkwy., Fremont, CA 94538. 415/657-2211, 800/288-8754, 415/683-9713 fax*

### PM1.44

An external 3.5-inch SCSI floppy disk drive that reads compatible file formats from IBM, DOS, and Macintosh computers. Can be stacked on top of the Cube.

*$849. Pacific Microelectronics, 201 San Antonio Cir., Ste. C250, Mountain View, CA 94040. 415/948-6200, 800/628-DISK, 415/948-6296 fax*

### PMHDE

An external SCSI hard disk drive enclosure that accommodates 3.5-inch or 5.25-inch hard disks. Provides additional external disk storage of up to 7 gigabytes. Can be stacked on top of the Cube or mounted in a rack.

*$695. Pacific Microelectronics, 201 San Antonio Cir., Ste. C250, Mountain View, CA 94040. 415/948-6200, 800/628-DISK, 415/948-6296 fax*

### Scan-X Color

A flatbed scanner that scans at resolutions of up to 2400 dots per inch for line art and 400 dots per inch for color and grayscale images. Supports TIFF and EPS formats and the NeXT pasteboard.

*For price, contact HSD U.S. HSD U.S., 1350 Pear Ave., Ste. C, Mountain View, CA 94043. 415/964-1400, 415/964-1538 fax*

### Scan-X Professional

An 8-bit scanner that scans at resolutions of up to 1500 dots per inch for line art and 300 dots per inch for grayscale images. Saves in TIFF and EPS formats, recognizes 256 levels of grayscale, and scans legal-size documents. Optional 50-page sheet feeder and OCR software available.

*$2195. HSD U.S., 1350 Pear Ave., Ste. C, Mountain View, CA 94043. 415/964-1400, 415/964-1538 fax*

### SCSI488/N

An IEEE 488 interface plus a software driver that gives the NeXT computer control of up to 14 IEEE instruments. Uses familiar Hewlett-Packard–style IEEE commands while providing transfer rates as high as 900KB per second. Attaches to the SCSI port, leaving an expansion slot open.

*$1495. IOtech, 25971 Cannon Rd., Cleveland, OH 44146. 216/439-4091, 216/439-4093 fax*

### VISUS Digital Document Scanners

The Personal Page Scanner (with optional autofeeder) scans any document up to legal size. For high-volume workload and larger documents, the Departmental Scanner (11 x 17 inches) and the Large Format Scanner (24 x 60 inches) scan at resolutions up to 400 dots per inch. The Industrial Scanner scans at resolutions up to 2000 dots per inch with an absolute gauging accuracy of .002 inch over a distance of 24 inches.

*$1395 for Personal Page Scanner; $2295 for autofeed; $17,995 for Departmental Scanner. Visual Understanding Systems, 3400 Forbes Ave., Pittsburgh, PA 15213. 412/488-3600, 412/687-7065 fax*

### VISUS Fax Modems

A pocket-size, battery-powered, Group III device that sends, receives, and automatically files faxes. Designed for high-volume applications and supports Professional PaperSight workgroups over a NeXT network.

*$995. Visual Understanding Systems, 3400 Forbes Ave., Pittsburgh, PA 15213. 412/488-3600, 412/687-7065 fax*

## Scientific

### DAN, The Data ANalyzer 1.0

An engineering and scientific data analysis system. Capabilities range from input and output of several data file formats to table generation, mathematical manipulation of data tables in memory, and complete X-Y coordinate-plotting support. Any number of overlaid plots are available with distinguishing styles, plot symbols, and grayscales.

*$795. Triakis, 560 Bryce Ave., Los Alamos, NM 87544. 505/672-3180*



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### Groups

An effective aid for anyone studying group theory, abstract algebra, or the mathematical methods of physics and chemistry. Contains all finite groups up to and including order 20 and can compute the group table, orders and inverses of all the elements, center of the group, commutator subgroup, conjugacy classes, and all subgroups and normal subgroups and their left and right cosets and quotient group.

*$20; $80 for site license. Halchin and Fleming, 2122 Reynolds Dr., Charleston, IL 61920. 217/348-0917*

### Mathematica

An application for both interactive calculation and high-level programming. Performs almost any numerical, symbolic, or graphical mathematical manipulation. Displays 2D and 3D plots of functions and data and 3D object modeling.

*For price, contact Wolfram Research. Wolfram Research, 100 Trade Center Dr., Champaign, IL 61820. 217/398-0700*

### Math++ 2.0

A C-language math library of 100 functions designed to support numerical analysis in applications. Includes over 1.5MB of source code and a 470-page user's guide with numerous program examples.

*$295. Triakis, 560 Bryce Ave., Los Alamos, NM 87544. 505/672-3180*

### Rubik Algebra

An application that uses the Rubik's cube as a tool for illustrating, generating, and exploring a variety of ideas and basic theorems from elementary group theory. Can decompose an arbitrary sequence of face rotations into disjoint cycles, in order to illustrate the order of an element in a finite group, the effect of conjugation on cycle structure, and even and odd permutations.

*$20; $80 for site license. Halchin and Fleming, 2122 Reynolds Dr., Charleston, IL 61920. 217/348-0917*

### Spring

A program for exploring the second-order differential equation that models the motion of a mass on a spring. Features graphs and real-time animations of the solution and the parts of the solution. Useful for teaching and studying university-level mathematics.

*$20. Halchin and Fleming, 2122 Reynolds Dr., Charleston, IL 61920. 217/348-0917*

### Taylor

An interface to Mathematica that allows users to investigate Taylor polynomials. Users specify the function to be approximated, the degree of the Taylor polynomial desired, and the center point of the expansion. Taylor then graphs the function and its approximating polynomial on the same axes.

*$20; site license $80. Halchin and Fleming, 2122 Reynolds Dr., Charleston, IL 61920. 217/348-0917*

## Text Processing/DTP

### Adobe Plus Pack

A collection of 26 additional fonts to supplement the 13 standard fonts on NeXT computers. Typefaces include Palatino, ITC Bookman, ITC Zaph Chancery, ITC Zaph Dingbats, ITC Avant Garde Gothic, ITC New Century Schoolbook, and Helvetica Narrow and Condensed.

*$495. Adobe Systems, 1585 Charleston Rd., Mountain View, CA 94039. 800/344-8335, 415/961-3769 fax*

### FrameMaker 2.0

A publishing environment that integrates word processing, graphics, page layout, equation-editing, and book-building tools.

*$995; academic price $495. Frame Technology Corporation, 1010 Rincon Cir., San Jose, CA 95131. 408/433-3311, 408/433-1928 fax*

### TextArt 1.0

A combination drawing package and PostScript generation tool that skews text, places it in a straight line, around a circle, or in an arc or rose, and adds shadows. Controls letter placement with track, sector, and pair kerning. Basic drawing functions combine images with geometric shapes and EPS or TIFF graphics.

*$375. Stone Design Corporation, 2425 Teodoro N.W., Albuquerque, NM 87107. 505/345-4800, 505/345-3424 fax*

### The Font Company Type Library

A library of more than 1500 PostScript Type 1 typefaces. Buyers can purchase any number of fonts.

*Price varies with the number of typefaces purchased. The Font Company, 12629 N. Tatum Blvd. # 210, Phoenix, AZ 85032. 602/998-9711, 800/442-FONT, 602/998-7964 fax*

### TouchType

"Accessory software" for creating and controlling display type for book covers, titles, logos, and other projects. Simple to use and powerful.

*$249. RightBrain Software, 20 Medway Rd., Woodside, CA 94062. 800/472-7246*

### WordPerfect

A word processor featuring columns, macros, merge, table of contents, indexing, spell checking, a thesaurus, footnotes and endnotes generation, graphics manipulation, and an automatic timed backup system.

*$495. WordPerfect Corporation, 1555 N. Technology Way, Orem, UT 84057. 801/225-5000*

## Vertical Market

### VTLS InfoStation 1.0

A hypermedia information-access system for library automation. Provides on-line catalog search and retrieval of audio, textual, and graphic data. The audio-visual help system gives users digitized voice instructions, line drawings, and text explaining how to use the program.

*$995; contact VTLS for network prices. VTLS, Virginia Tech Corporate Research Center, 1800 Kraft Dr. #200, Blacksburg, VA 24060. 703/231-3605, 703/231-3648 fax*

### TranScriber 1.0

A record transcription tool for physicians and medical transcriptionists. Runs on local or remote workstations. Finished reports may be stored in either WriteNow or ASCII text formats.

*$395. Toltec Human Services, 5005 N. Pennsylvania Ave. #301, Oklahoma City, OK 73112. 405/840-4254, 405/840-3041 fax*

## Other Products

### The First Compilation Disk

A collection of 400MB of the most popular software publicly available for NeXT computers. Includes utilities, programming languages, games, and information files. Also comes with one year of NeXT-specific Usenet network news and hundreds of old-fashioned UNIX programs.

*$249. Lighthouse Design, 6516 Western Ave., Chevy Chase, MD 20815-3212. 301/907-4621, 800/366-2279*

### TheLibrary

An on-line information system for application developers and information publishers designed to work like the public library, "books" are found through a card catalog and located on "bookshelves." Features interactive on-line versions of books.

*For price, contact We Design. We Design, 4286 Redwood Hwy. #237, San Rafael, CA 94903. 415/479-1105, 415/449-0967 fax.*



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# Classified

*NeXTWORLD* magazine Classifieds is a bimonthly feature. Rates effective January/February Issue, 1991. Per-line rates $40.00. Thirty -six characters equal one line (count each letter, space and punctuation mark as a character). Four-line minimum, seven lines per inch. For column inch rates, please call or write for complete rate card information. Check or money order (or certified check) must accompany copy and be received six days prior to close date. All ads accepted at the discretion of the publisher. *NeXTWORLD* magazine 501 Second St., San Francisco, CA 94107 415/978-3182.

## USER GROUPS

The NeXT™ experience is meant to be shared. Connect yourself to the NeXT community through the Bay Area NeXT-user Group. For more information, contact BANG at: bang_request@meta-x.stanford.edu or P.O. Box 8858, Stanford, CA 94309 or fax 415/ 957-0512.

## DESIGN SERVICES

Eye-catching icons and logos at affordable prices. In need of icons or logos for your NeXT™ application? Call Knox Design. In addition to designing icons and logos for top-selling software products, Knox has also produced a clip art library containing over 400 illustrations. Our diverse styles will give any software application a crisp professional look and feel while conveying their intended message. Knox Design, 300 Broadway, #29, San Francisco, CA 94133 415/ 398-0136.

## CONSULTING SERVICES

**Software consulting.** We have extensive experience working for the biggest names in the industry. For top-notch talent you can count on, contact EmSquare Engineering, Inc. 14132 177th Avenue NE, Redmond, WA 98052. 206/882-2087

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*Continued from page 80*

tory he wants to negate, the interpersonal encounters she longs to have. Virtual worlds, indeed, that bear little resemblance to the simulation on our screens.

The roots of virtual reality technology can be found in CAD/CAM applications and in early flight simulation programs developed by the military. Applications appearing now are being targeted at such widely ranging fields as architecture, medicine, ecology, and telerobotics. It's no accident that Autocad, creator of one of the most widely used CAD programs, is involved in this research. It's also no accident that Virtus Walkthrough, a real-time virtual reality technology, uses as its metaphor an architectural model that lets you appear to walk around in familiar 3D space. What makes it exciting is that your movements are displayed nearly instantaneously, without requiring time for the screen to redraw. What makes it dull is that the constructions are quite primitive.

But reality stops at the simulated door. Of late, the visions for virtual reality include creating alternate worlds that you can physically enter. At this extreme edge, virtual reality would precipitate an ultimate encounter between human and computer, one that allows a person to experience and manipulate a synthetic world that feels just like the real world. The high-fashion garments sported in this world are nerdy, tight-fitting computer clothes, and instead of looking at a screen, you wear clumsy goggles that widen your vision, and suits with sensors that communicate sensations. You look a little like a space invader, but the space you enter is cyberspace, and the laws of real space do not apply.

In 1991, however, our technology still can't keep up with your imagination, and virtual reality is more hyperbole and promise than substance. As amazing as the Virtus product is, it offers only a shell of a self to try on—just a "presence" in the landscape—a bit of digital skin wrapped around empty space. Very crude skin. You can get into this skin, but really, your own skin is much more interesting. So what's all the fuss?

The secret of virtual reality is really quite simple. *It's what it's not*—yet—that interests people.

**The digital self.** The state of the art, at the site of the desktop, is crude, as I've said, but our dreams for it are not. What you may have read about virtual reality amounts to a fantasy world gone wild. So much for modeling alternate environments. Our fascination really derives from imagining *ourselves* in it, but changed, freer, more exotic. Virtual reality is a kind of metaphysical divining rod. We wave it over our psyches to pinpoint and tap an archetypal wellspring in our soul, so that it rises up and uproots our old image of ourselves. It's better than films or literature, or so it seems, because we're not *outsiders* who passively observe these fantasy worlds. We're *participants*. We make it happen. And it's not another world that really interests us, but another *self*.

Whereas up until now we have used the computer to model the myriad tasks of our intellect, from financial analysis to chess moves, we're now fascinated by the prospect of modeling the *psyche*. It's the digital progeny of 20 years of escalating self-absorption. A generation of clinical self-scrutiny, in which we've labeled the self just as surely as if we'd stamped it with a bar code, has resulted in a self that evaporates behind our eyes, lost in a welter of demographics, zip codes, acronyms, self-help movements, and brand names. Absorption with the self has led to the self's being absorbed in a model of the self. Preoccupation with the self has led to ennui with the self and a desire to mold the self as if it were plastic, or *bits* and *bytes*, and short of that, to abandon the known self in a virtual world, to become the other selves that we've yearned to become.

The sad fact is that we haven't been satisfied with partial measures, such as dying our hair, injecting silicone into our lips and breasts, searching for who we are through psychoanalysis, vacations, meditation, drugs, and falling in love. We want to remove ourselves to a faraway country, where we can remake that elusive self any way we like. In this virtual reality of our minds, we abandon the quest for self-knowledge and opt instead for a tour of a theater of the self.

From this perspective, computer technology plays a key role in reshaping this shape-shifting self. Think about how much of our preoccupation with computer technology involves making connections with others: proliferating local and global networks, managing workgroups, exchanging information, resigning ourselves to promiscuous communications practices and the omnipresence of communication devices. In the world of Jaron Lanier (founder and CEO of VPL, a firm that has developed eye phones and data gloves for virtual reality systems), reality is built for two or more, and with good reason. When the self disappears, being alone is terrifying, whether in this world or its virtual version.

**Is Paris burning?** It's the year 2000 and perhaps Paris *is* burning—but maybe you don't care, since you've got a copy of Paris on your hard drive. The digital version of Paris is also palpably real, with over 20,000 scanned-in color images that can be displayed alongside real-time video, all in 32 bits, with 8 bits for transparency. As we play in the virtual city, we look through the transparent window of the car in the foreground, while off in the distance, simulated flames appear to destroy the Eiffel Tower. We flip to another database, the core of an ecological simulation where a whole rain forest appears to be cleared in a matter of days. We flip on our computerized TV, but we can't tell whether the war we're watching is a simulation spliced from old movies or the beginning of another real one that appears to be broadcast from the cameras of CNN and the shifting sands of the Middle East.

In one version of this brave new virtual world, simulation is everything and reality, nothing. How fascinating, we think, as we flip through cities with virtual lightning speed. How fascinating, too, the disquieting question, reported by the *New York Times*, that a five-year-old boy asked his father while sitting in the bleachers at a baseball game: "Dad, is this live?"

I imagine that, for the space of a nanosecond, the father had some difficulty with an answer for his son.

*With thanks to Daniel Gregory, Laurin Herr, Michael Miley, Russ Newman, and Richard Schatz.*

**Vanishing Point** *is a freewheeling site for key thinkers and futurists who do their thinking beyond the cutting edge of information technology.*

**Hazel Kahan** *is a psychologist living in New York City, where she runs her own market research firm.*



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# Vanishing Point/Hazel Kahan

**It's 1992. You're an architect. You know the challenge of getting a client to visualize a building not yet built. So you sit him in front of your computer and walk him through a virtual version of it in 32-bit color.**

Ghostly presences, the two of you move under a CAD version of vaulted ceilings, climb stairs, stroll from one archway to another, open the door onto the courtyard. It's four in the afternoon. In simulated sunlight the benches and bushes in the courtyard cast long, lovely shadows across the patio. He's satisfied with your plan. You shut the computer down and the patio disappears.

It's 1996. You're a cop and New York is overrun with gangs. It's as if the whole population is the enemy. At the Main Terminal Building of the N.Y.P.D., you open the door to the simulation room and find the 12 members of the counterinsurgency team already there, jacked into their terminals, waiting for you. You suit up and sit down in front of your terminal and log in to the game *To Live and Die in New York*. Your body suit is geared to give you the sensation of physical pain, of vertigo. This is called rumble training. Before you know it, it's midnight and you're out in Times Square. As you move down the street, you don't know whether or how you will be killed, or whether you will be mourned by your team. "By the knife," you think, "No doubt, I'll die by the knife."

Cut to 1991.

Welcome to the world of virtual reality.

**It's what it's not.** Virtual reality is a concept that has spread like simulated brushfire across your computer screen. Modem into a database and you'll find extensive references to virtual reality across a range of sources that go well beyond the nerd and the alternative press. Virtual reality congresses are springing up in New York's Soho, Holland, and Australia, as well as Silicon Valley. Articles are appearing in philosophical journals as well as in the "Style" section of the *New York Times* and in such staid publications as *Smithsonian*. Virtual reality has attracted so much attention that the concept no longer seems arcane or hip, as it did just three months ago. But the question remains...What is it?

The answer depends on who you talk to. Interestingly, virtual reality has become a kind of digital Rorschach inkblot onto which people who discuss it project their most personal fantasies. If you think I'm exaggerating, conduct your own experiment. If you're interested in finding out what makes somebody tick, ask him or her to describe their version of virtual reality. Complain that you don't get it. In response, you'll uncover a few juicy secrets: the adventures he wants to have, the selves she wants to explore, the personal his-

*Continued on page 79*

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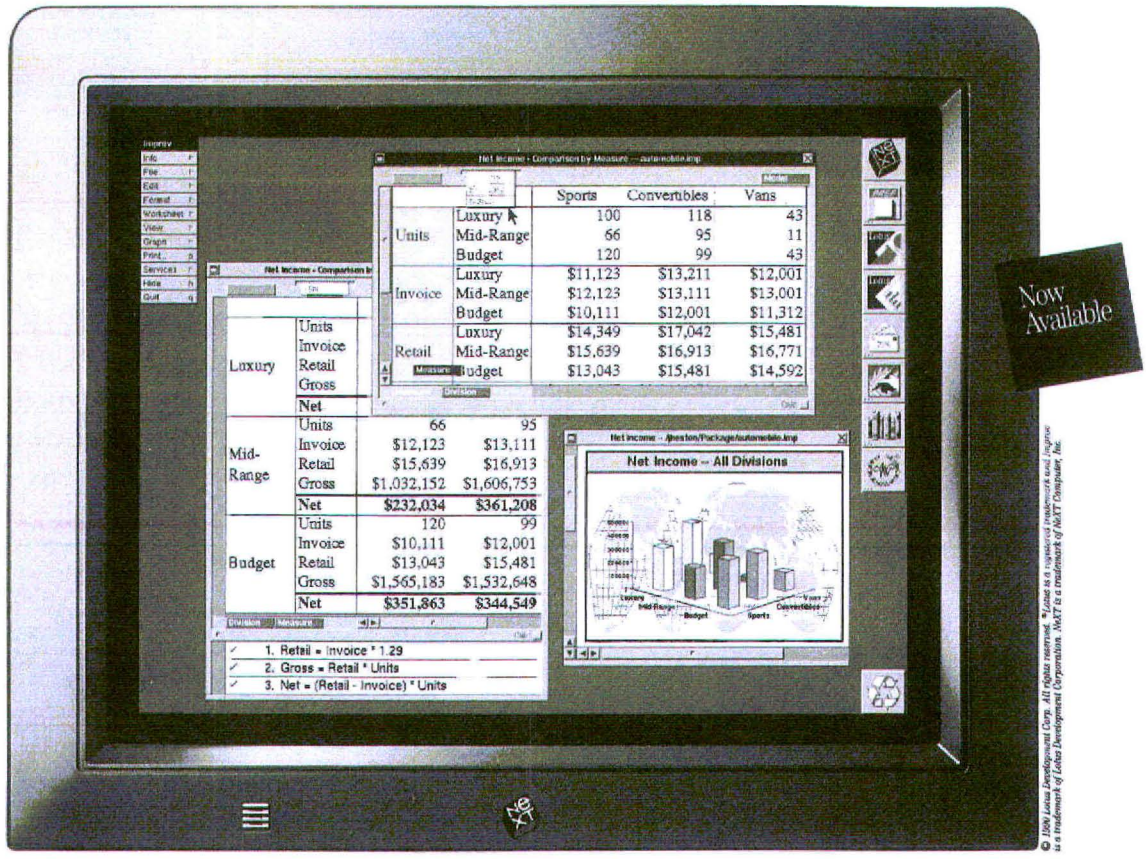


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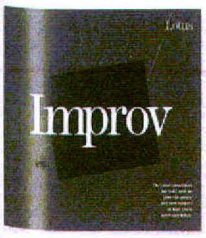


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